Light and Lighting

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Light and Length

THE connection of light with lighting is plain enough, but what has light to do with length? Well, of course, light waves have length and so they afford a natural and reproducible basis in terms of which fundamental standards of length, like the Imperial Standard Yard, can be defined. If the wavelength of a suitable monochromatic light is used as the ultimate standard of length, it is possible, by the use of interferometers, to measure lengths up to 12 inches to an accuracy of one millionth of an inch. Cadmium red light has already been used to determine the standard yard and metre, but investigation is now in progress to find whether the green light from a mercury isotope, produced by exposing gold to neutron irradiation in an atomic pile, has a wavelength more suitable as the ultimate standard of length. This new use of light in the service of man was recently demonstrated at a joint reception by the Government and the Royal Society to mark the fiftieth anniversary of the National Physical Laboratory. It is an innovation that doubtless will be succeeded by others; for who can foresee a limit to the uses of light?

Notes and News

International Congress of Ophthalmology

This important Congress, the sixteenth of its kind, which is to be held in London, from July 17 to 21, is expected to attract some 2,000 ophthalmologists from different parts of the world. The President of the Congress is Sir Stewart Duke-Elders, K.C.V.O., M.A., D.Sc., M.D., F.R.C.S., whose monumental Textbook of Ophthalmology is a world classic and who, besides his eminence as a consultant and practising eye surgeon, is well known for his research work: he is, indeed, the Director of Research at the Institute of Ophthalmology, which is associated with the Moorfields, Westminster and Central Eye Hospital and is also a post-graduate school of the University of London. The Secretary-General to the Congress is Mr. Frank W. Law, M.A., M.D., F.R.C.S., who is President of the Faculty of Ophthalmologists and is also well-known to members of the I.E.S.

The main discussions will be concerned with the genesis of high blood pressure and its effect upon the eye and with the clinical and social aspects of heredity in ophthalmology, though there will be a number of papers devoted to other ophthalmological subjects.

A lighting exhibition will be one of the features of the Congress, and this will be arranged in the Public Health Museum of the London School of Hygiene and Tropical Medicine, Keppel-street, London, W.C.2. The exhibition is being organised by the Illuminating Engineering Society with the support and assistance of the leading associations in the lighting industry.

Exhibits are being prepared to illustrate the fundamental principles involved in the design of good natural and artificial lighting in buildings. The variation in the amount of illumination required according to the characteristics, e.g., size and contrast, of the objects principally governing the severity of visual tasks in industry, schools, offices and domestic dwellings will be demonstrated; so also will be the significance of other conditions of lighting, e.g., the direction, diffusion and spectral quality of the light, as well as its distribution throughout the environment, upon the comfort, visual hygiene and occupational efficiency of room occupants.

Portable instruments for the measurement of illumination and brightness will be exhibited, and a special feature of the exhibition will be a demonstration of the operation and characteristics of fluorescent lamps. There will be exhibits of scientifically designed lighting equipment, and the use, in practice, of selected lighting units and systems of lighting will be exemplified in suitable rooms. Special lamps and equipment useful in ophthalmic practice and research (e.g., high intensity flash lamps for photography of the eye, and operating lamps) will be shown.

Other exhibits will show the combination of optical aids with suitable lighting for "fine" work in industry and elsewhere, the lighting of test-charts, and the environmental application of colour and

Next I.E.S. Sessional Meeting in London

The next I.E.S. sessional meeting in London will be held at the Lighting Service Bureau, 2, Savoy Hill, W.C.2, at 6 p.m., on Tuesday, March 14.

At this meeting a paper entitled "Acrylic Enclosures for Flameproof Lighting Equipment," will be presented by Mr. P. H. Collins and Dr. W. E. Harper. The paper describes tests which have been carried out on the use of methacrylate in mine lighting fittings and gives the results of these tests.

its effect upon the utilisation of light and the achievement of satisfactory brightness gradients within the visual field. In addition, there will be exhibits dealing with British mandatory lighting requirements, e.g., in factories, schools and mines, with, it is hoped, an exhibition of modern mains lighting at the coal face. There will also be explanatory exhibits dealing with the recommendations for good lighting practice which are incorporated in recent Codes issued by authoritative bodies.

Lighting in Sweden

One of the addresses to be given at the I.E.S. Buxton meeting is by Mr. Ivar Folcker, who will be describing lighting developments in Sweden during the past ten years. Mr. Folcker is one of the leading lighting engineers in Scandinavia. Graduating from the Royal University of Technology at Stockholm in 1916 he served as an electrical engineer with a number of firms until 1925 when he joined the Osram Company in Stockholm, later becoming chief engineer. For a number of years he had acted as the honorary secretary of the Swedish Lighting Association, becoming managing director in 1948. Due to his efforts the Swedish Illuminating Engineering Society came into being in 1942, and in 1945 he became President, a position he still holds. He is also Chairman of the Swedish National Illumination Committee and in 1948 he was elected a Vice-President of the International Commission on Illumination. There will be little doubt therefore that Mr. Folcker's address at Buxton will be an authoritative one.

One of the most influential factors in lighting development in Sweden during the past ten years has, of course, been the advent of the fluorescent lamp. With this new light source it has been possible to raise the standard of lighting, and the new values of illumination for various tasks which were adopted in 1948 are twice, and sometimes three times, as high as those previously recommended (though still apparently lower than in this country). At the same time there have been demands for improvements in lighting "quality," and attention has had to be given to the glare which often results from the use of fluorescent lamps.

Though fluorescent lighting is not used indiscriminately in factories it is felt by many that there should be some difference between the kind of light used in the factory and in the home, with the result that fluorescent lighting applications in the home are still limited. Progress in the field of home lighting has, however, as in many other countries, been comparatively slow. Work on suitable fittings is being undertaken and anything that Mr. Folcker has to say on the subject of home lighting will no doubt be welcome.

Home Lighting

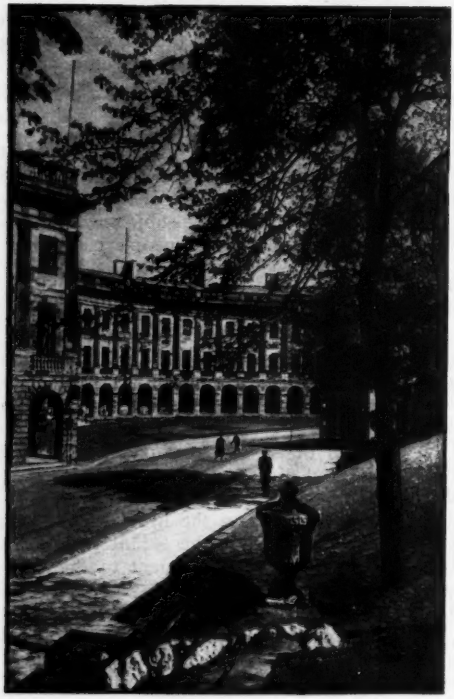
We feel that home lighting is a subject that has been very much neglected. We also feel that anyone who tries to lay down any rules on the subject would be a very bold man. Few people have much idea on how to set about lighting their homes and the majority of us show little or no imagination when faced with the task. Too often we are given every discouragement from using our imagination by the architect or builder (or other authority) who provides a single point in the centre of the ceiling and leaves us to do our best. This method of lighting is quite out of date and we hope that these people will not permit austerity to prevent them adding the little extra wiring which will enable the tenant to add his own decorative component to the lighting of his or her home.

Mr. C. H. Pellow, speaking at a recent London meeting of the I.E.S., reported that in Australia a good deal of thought has been given to domestic lighting and, at least in living rooms, wiring is no longer taken to a central point in the ceiling. It would be interesting to compare practice in different countries.

We hope to include in our pages a number of articles on home lighting during the next few months, and we hope that our readers will find them interesting and useful.

BUXTON—Venue for the I.E.S. Summer Meeting May 16-19

The I.E.S. Summer Meeting will attract many lighting engineers from this country and from overseas. The following briefly describes the amenities to be found in and around Buxton.



The Crescent.

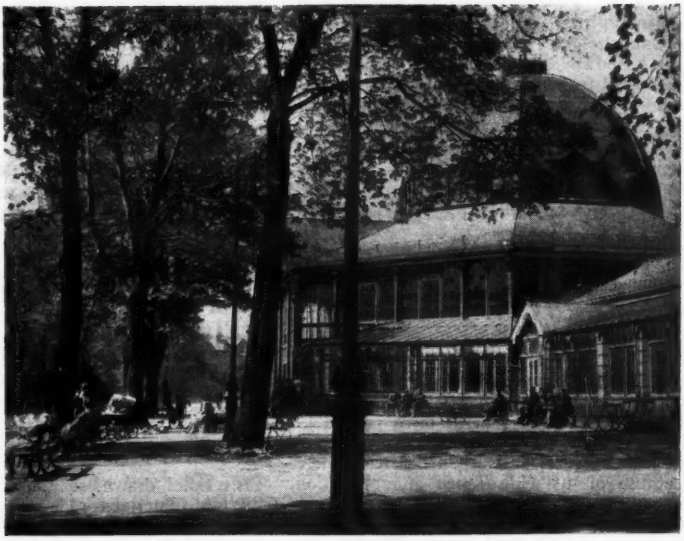
Recreational facilities for all tastes.

Much as we admire the scenic beauties of our country it is not usual for us to take up space in this journal to extol the attractions of one place in favour of another. But we have a special reason for mentioning Buxton, and are glad to note that these days it frequently occurs in conversations between lighting engineers and in interviews (being slightly more formal than conversations) between lighting engineers and their directors. The reason, assuming that you read neither sub-titles nor notices, is that Buxton is to be the venue for the I.E.S. Summer Meeting, which will take place there from May 16 to May 19 next.

One advantage of Buxton as a conference centre is that it is most amazingly central. Not only is it the centre of the Peak District (and could there be any more attractive claim to fame?) but it is pretty nearly the centre of the country, and very accessible from north, south, east and west. For those north of the border it should be an easy road to follow; they reached Derby in the '45, when the going was pretty hard, so, in this jet-propelled age, Buxton should be child's play. From the east the proximity of the Leeds and Sheffield Centres, who put on such a good show of their own at Harrogate two years ago, should mean the presence of a large number of Yorkshiremen. From the south we expect an exodus which will denude lighting departments of all their staffs for the duration, whilst from the west we feel sure that the Liverpudlians will attend in force to support the Mancunians who have a large share in the organisation of the Buxton meeting.

The conference facilities at Buxton are excellent. The town is not a large one, and the meeting place is but

The Concert Hall, Pavilion Gardens.



three or four minutes' walk from the headquarters hotel and no farther from the majority of other hotels. The meetings will be held in either the Playhouse or the Opera House, both of which are within the same group of buildings alongside the Pavilion Gardens, and each shares the same indoor facilities for informal conversations before, between, and after meetings. Also in the same locality is the Pavilion. where the opening civic reception and the mannequin parade for the ladies will be held.

The country around Buxton contains some of the finest scenery to be found. The approach by road or rail prompts one to explore further. Two tours are included in the I.E.S. programme; one for the ladies, who, in the course of an afternoon tour, will be able to visit Haddon Hall, the object of much local legend, which is situated on the banks of the Wye; the other tour being for all and sundry, and covering another part of the Derbyshire Dales, depositing members back at their hotels in goodly time for their dinner on the last evening of the meeting. We will say little more about the surrounding countryside; we have had little experience at writing in guide book style, and can only say that what we have seen of Derbyshire has persuaded us that we have a duty to others in seeing that they do not miss the opportunity of seeing it.

We have said nothing about the business side of this meeting. That has been dealt with elsewhere, and I.E.S. members will no doubt receive further reminders on the subject in due course. After whole mornings, or even afternoons, of concentration, however, the lighting engineer enjoys his recreation as much as the next man. Buxton provides everything. From doing just nothing to rock climbing, from croquet to golf, the facilities required by the various addicts are there to be used.

A special word for the golfers. During the period of the meeting, members will be able once again to play for the Dow Golf Cup, the first competition for which took place in 1948 at the Society's first Summer Meeting. Facilities have been made available at the Cavendish Golf Club, which is situated only 10 minutes' walk from the centre of the town. The course is over nearly 6,000 yards and includes many fine natural features—streams, brooks, and even ravines —so that perhaps we shall see the golfers doing a little rock-climbing as well.

Golfers have their eyes on the Dow Cup.

Lighting in Rural Areas

By T. H. TAYLOR

With the recent improvements in light sources and their applications, little attention is now given by lighting engineers to lighting conditions in rural areas where supplies of town gas or electricity are not available. The following article describes the use of "Calor" gas in improving lighting conditions in such places.

"Calor" gas is a mixture of paraffin hydrocarbons, and is obtained during the processes of oil refining and hydrogenation. It consists primarily of butane and propane, is non-poisonous, twice as heavy as air and has a heating value six or seven times greater than that of town gas.

As a fuel it is becoming increasingly popular in rural and urban districts, where, because of its wide range of application, ease of control, cleanliness, high efficiency and availability it is no less important than town gas in industrial areas. "Calor" gas and town gas perform precisely similar functions in different spheres and, except in particular instances, it is unlikely that their areas of application will overlap.

The gas is distributed in liquid form, in steel cylinders. Under normal conditions the pressure in the cylinders is about 25 lb. per sq. in., but it varies according to the gas composition and atmospheric temperature. One pound of liquid will produce approximately seven cubic ft. of gas.

The pressure regulator—which works between limits very much closer than those obtained in normal town practice—serves to reduce the pressure of the gas issuing from the cylinder, from cylinder pressure to the operating pressure of the appliance (usually 10 in. W.G.).

In all installations the cylinder should be as close to the appliance as is practicable, should be easily accessible for changing, and must be kept upright—otherwise the liquid may enter the pipes. Since the vaporisation of the liquid and the consequent production of gas are dependent on the heat transfer from the surrounding air to the cylinder, the storage compartment must be adequately ventilated. For the same reason the cylinder must neither be wrapped nor lagged, and in no circumstances should it be housed in a place which is subject to excessive change in temperature.

Materials used in a "Calor" gas installation should be resistant to the action of the gas. Solid drawn, semi-annealed copper is the best material for piping, and the fittings should be of the compression type. It is recommended that flexible connections be used only where this is unavoidable, and in any case they should be of an approved type.

"Calor" gas has a high calorific value, so that much smaller pipes can be used than for town gas. This leads to greater ease of fixing and to less obtrusive pipework. There is, however, the obvious disadvantage of the greater risk of blockage, especially as injector orifices are smaller. Care should be taken, therefore, to prevent the entry of all foreign matter into the system, particularly when changing cylinders.

Although the foregoing facts may appear somewhat irrelevant to the main subject, users of "Calor" gas lighting should be acquainted with them if they are to get a satisfactory performance from their installations.

All experience in "Calor" gas installations has an analogy in town gas experience of the same sort, and for this reason the experience of the town gas industry is often a valuable guide in prophesying future trends in the "Calor" gas industry. Experience in town gas lighting has frequently been that, as electrification progresses, the gas lighting load decreases. In fact, one of the main incentives to the extension of the town gas market to cooking, water and space heating and industrial applications has been the progressive reduction of what was once its mainstay, the lighting load. From this experience the analogy would appear to be that "Calor"

gas lighting is destined for the same fate; on reflection it will be clear that this is not so.

The circumstances attendant on the competitive position of town gas and electricity on the one hand, and "Calor" gas and electricity on the other, are quite different. Primarily, "Calor" gas is used in small hamlets, villages and other communities far from the source of electrical generation and which are often quite isolated. Even if reasonably close to a source of the supply, the anticipated load is unremunerative because of the low load factor.

In addition, the distance involved in bringing these communities into the town gas or electrical orbits are often very great. Some opinions are that, except in "fringe" communities, paraffin is the only competitor to "Calor" gas for lighting. By far the largest portion of the lighting market in rural areas is supplied by paraffin, but it can be said that, from the point of view of efficiency and the advantages previously mentioned, the competitive position of "Calor" gas is very strong and that the load will be gradually captured by the more efficient fuel.

Applications

In churches, public halls and other places where lighting projects, other than simple house installations are concerned, "Calor" gas is the ideal fuel. It is a very satisfactory method for school lighting. As an example, in one particular case an illumination of 12 lumens per sq. ft. on the desks and 20 lumens per sq. ft. on the blackboard was obtained by running three rows of lights 8 ft. apart with the addition of two small bijou lamps for blackboard illumination.

Until the introduction of "Calor" gas in this country, it was impracticable for modern road safety devices, such as illuminated bollards and signs, to be used in rural districts without town gas or electrical supplies. With "Calor" gas there is no reason now why every modern aid to road navigation should not be available in any rural district.

The methods adopted for various types of sign are illustrated in Figs. 1 and 2. In the case of warnings and prohibitory signs, external illumination is preferred because of better daytime performance. The legibility of illuminated signs may be impaired by lack of uniformity of brightness over the area of the sign. This is an important consideration in the location of light sources in relation to the illuminated area. In the case of prohibitory and mandatory signs, the red disc and red ring must receive illumination as well as the sign itself. Each is illuminated from the top, using special reflecting cowls.

In caravan lighting, "Calor" gas has proved itself the most efficient fuel, and its use for this purpose has become more important in recent years when, because of the

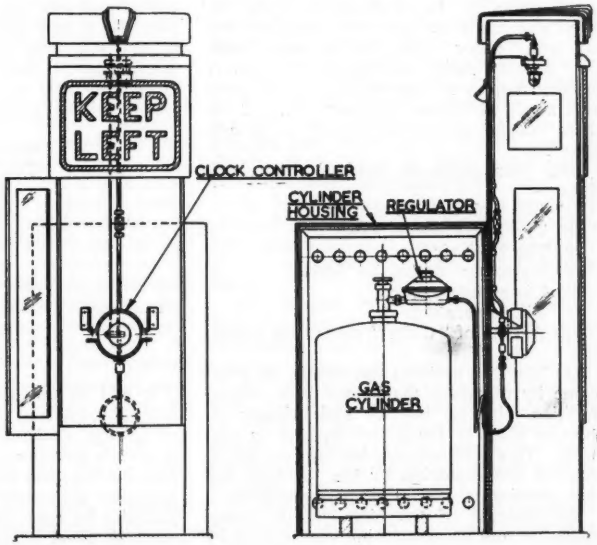


Fig. 1. Arrangement of gas supply and lighting equipment for internally illuminated bollards.

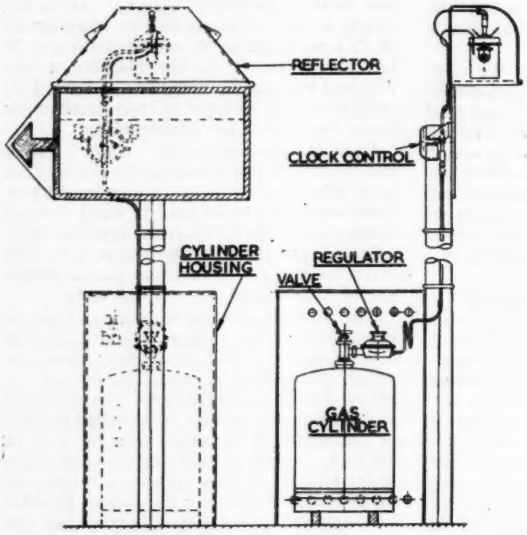


Fig. 2. Showing an arrangement for external illumination for traffic signs.

housing shortage, many people have made caravans their permanent homes.

Since the combustion problems associated with burning "Calor" gas are not widely appreciated, there is a tendency to suppose that any town gas appliance will be suitable. This is not true, and the majority of equipment needs to be re-designed from the apparatus made for use with town gas but not with "Calor" gas. On the other hand, it is simpler, easier and cheaper to convert existing designs of lantern, etc., than to start an entirely new range of appliances, and for these reasons the former course is usually adopted.

The main problems involved are as follows:—

(a) The high specific gravity.
(b) The high calorific value.
(c) The high air requirement.
(d) Narrower combustion limits.
(e) Lower flame speed.
(f) Pilot operation.
(g) Affinity of "Calor" gas for oil, grease, etc.

(a) The first problem can usually be overcome by mounting the burner in a vertical position with the injector and primary air port as close to the burner nozzles as possible. This automatically involves consideration of contamination by flue products and the question of special air passages arises.

(b) Because of the high calorific value, materials and manufacturing standards of injectors must be of a very high order, and when considered in conjunction with (d) it is clear that the range of suitable air gas ratios is narrow and could easily be upset by orifices inaccurately drilled or positioned with relation to the air ports.

(c), (e) and (f) have previously been discussed and methods proposed for the solutions: (g) is very important for "Calor" gas is very searching and will penetrate where normal gas is satisfactory; for this reason all cocks have to be spring loaded and special lubricants employed.

Performance of "Calor" Gas Lighting Burners

Size	Hrs./32 lb. cylinder	Consumption cu.ft./hr.	M.S.C.P.
Bijou ...	680	0.31	40/50
Universal	325	0.65	95/100
No. 2 ...	300	0.7	120/130

It will be apparent from the limited information given in this article that this means of lighting has definite possibilities. The field in certain directions, notably road and traffic sign lighting, has hardly been entered. The tendency to provide town amenities and facilities for rural districts has been followed and this trend is likely to continue.

Random Review of 1949

By B. F. W. BESEMER

Some comments on lighting progress, including equipment, apparatus and application, during the past year as seen by a practising lighting engineer.

This article, as we have tried to make clear in the title, wanders at random through lighting progress during 1949. Apart from a rather broad subdivision into light sources, fittings, etc., it makes no attempt to catalogue new bits and pieces of lighting equipment.

There are no doubt a number of new items of equipment, new and striking installations, and new contributions to the art and science which are not mentioned in the following pages. In compiling such a review it is possible only to touch on the many matters of interest to the lighting engineer, and we hope we have made a reasonable selection. Incidentally, views expressed in the review are those of the author.

Lamps

The mercury-cadmium compact source lamps which have been applied to the main lighting of the B.B.C. television studios will have been specially welcomed by the actors who, unlike their film and stage brethren, have no opportunity of resting between shots to recover from the heat. The 48 100-watt tungsten lamps formerly mounted close above the performers' heads on the tiny sets were a considerable ordeal, but the new lamps consume 7.5 kw. and produce negligible heat. Is this the first commercial application of compact source lamps? It is certainly the first permanent installation in a television studio.

The introduction of a dimming circuit for fluorescent lamps, demonstrated at the B.I.F., is entirely a British development, so still we lead, as we nearly always have, in fundamental developments in the lighting world. Introduced simultaneously with the marketing of coloured fluorescent lamps in this country, this dimming admits fluorescent lighting to the stage. The economy of load, especially in colour, is a major point in favour of its use.

Internally silvered lamps were another exhibit at the B.I.F. Their arrival is opportune to provide at cheap cost a spotlight punch, which the ubiquitous fluorescent lighting lacks.

The five foot colour matching lamp at only a shilling or two above the price of a normal fluorescent lamp fulfils an outstanding need for a rough and ready simulation of daylight. We hope that some enterprising lamp maker will give us back our "daylight" tungsten filament lamps in the not too distant future.

Fittings

The introduction of the shorter fluorescent lamps has cleared the way for fluorescent desk lamps, and at least one of the designs that we have seen can be described as both functionally and aesthetically satisfying. Selling at £5 or so they are an essential, if somewhat expensive, accessory for the up-to-date Big Business Man.

It is observed that wall brackets in the redecorated Town Hall at Maidenhead consist of fluorescent lamps threaded through trumpet flare cones. We first saw this trumpet flare motif at the French Colonial Exhibition in Paris in 1931, subsequently in Blackpool and elsewhere; but this is the first instance we know in which the physical properties of the fluorescent lamp have been enlisted to form an essential part of the mechanical structure of a lighting fitting.

The relaxing of lighting restrictions last April resulted in a spate of new fluorescent equipment specially designed for shop windows. This was natural enough in view of the fact that the occasion was the first since the fluorescent lamp was introduced on which it was permissible to use it for display purposes. The makers are to be congratulated on rising so rapidly to the occasion.

It has been suggested that the aesthetic design of lighting fittings lags behind functional design. This is something with which

we would like to agree, but where does functional design finish and aestheticism begin? To us a functionless twiddle is a meaningless twiddle. We consider that the primary need is to direct the attention of the aesthetic pooh-bahs to the existence of larger lamps. When will the Faculty of Royal Designers for Industry and the rest apply their talents to catalogue articles designed to take high wattage lamps? The new "Versatile" fittings are a case in point. An excellent and comprehensive range, provided one is content with 150-watt lamps.

From correspondence in the technical press during the year, some confusion seems to exist regarding the rival merits of local lighting and general illumination, for office lighting. Local lighting is not necessarily a bad thing in a private office if the occupier requires to concentrate entirely on his desk, but in a general office with several desks the distracting effect of numerous zones of light in an ambient pool of comparative darkness would soon impede output, even if the "ambient pool" were not sufficiently dark to cause an increase in the accident rate.

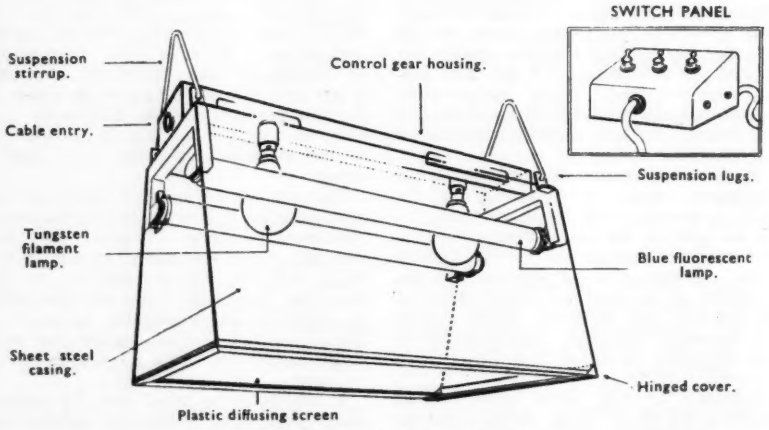
Siemens' Industrial Colour Matching Unit employs a combination of tungsten and fluorescent lamps and follows closely the black body locus in the 6,500 deg. K. region. Besides being, to the best of our knowledge, a colour matching unit which is a pioneer of its kind, it is also, we believe, the only one with any serious claim to the description "colour matching" which sells at less than £25.

Gear

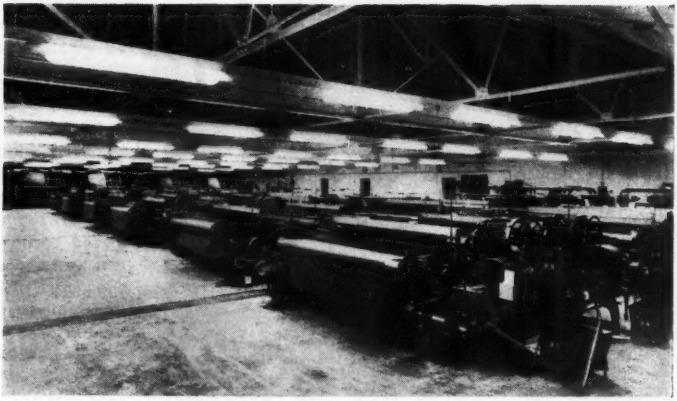
Some of the new fluorescent lighting fittings embody elaborate ventilating systems, with all the paraphernalia of wire mesh, strips, vents, baffles and the rest. If this complication is really necessary for present-day control gear it is time that the control gear was redesigned. It is high time that this was done anyway, even if the ventilating systems are redundant. Magnetic lines of force cannot be confined within a streamlined case, and the modern choke is a headache to the conscientious fittings designer. Where are the "Edlac" experts?

When the introduction of fluorescent lamps meant, as it did, that the common light source altered in size and shape from an orange to a 5 ft. rod, it put most of the existing integrating spherical photometers into the junk shop. The very much larger ones which then became necessary to secure reasonable integration were straightforward enough photometrically, but introduced many problems of mechanics to which the smaller ones were strangers. The new 12 ft. sphere at the G.E.C. Research Laboratory embodies such devices as a retractable steel "gang-plank" for the operator to reach the centre, and a door on chains and counterweights, which is raised and lowered by electric hoisting gear, secured with mechanical and electrical interlocks between gang-plank and gate mechanisms.

The spherical photometer for flash tubes shown by Siemens at the Physical Society's exhibition includes many features of interest, but the one which held our admiration



The Siemens' colour matching unit.



Showing "Arcon" lighting system in a weaving shed.

was its double-integration, for time as well as light. This was achieved by an emission photo-cell charging a low-leak capacitor to a voltage proportional to the lumens-seconds of the flash—simple, now that we know !

Street Lighting

Monsieur Gaymard's address on "Public Lighting in France and England," at the annual general meeting of the I.E.S., made the interesting point that in some Paris boulevards upward thrown mercury lighting is used to illuminate the foliage of the trees. Concrete columns are unpopular in Paris, and so also is aluminium paint, the street columns being painted to simulate weathered bronze. We forbear to seek in these differences some parallel with the differences in our national characteristics.

An article in LIGHT AND LIGHTING on "Reinforced Concrete Lighting Columns" opened our eyes—we had not appreciated that there was so much in the subject. But isn't 20 years a short history to give them ? We seem to remember them at the Empire Exhibition of 1924, or does our ageing memory begin to fail us ?

Industrial Lighting

The annual report of the Chief Inspector of Factories eulogises fluorescent lighting. One aspect sometimes overlooked is its flexibility, an important item where heavy machinery and frequent changing of the production line are involved.

It's an ill wind that blows no good, and one unforeseen effect of load-spreading, according to the chief inspector, has been that with the need to reduce the maximum demand, many lighting installations have been overhauled, eliminating ill-planned and extravagant systems and replacing them with properly designed efficient ones.

Another article which appeared in LIGHT AND LIGHTING during the year on "The Analysis of the Lighting Problem of an Industrial Undertaking," by F. G. Copland, is not strictly an analysis of the lighting problem, but an analysis of lighting economic problems. It is an article that everyone connected with lighting might well take to heart, if only to remind ourselves of the complexity of the facts which constitute costs.

The lighting in the weaving sheds of Messrs. Marling and Evans, Ltd., at Stonehouse, in Gloucestershire, is good but undistinguished. We remark on it because the whole installation of seventy-two 80-watt fluorescent troughs was wired and installed in seventy-two manhours. We gather that the entire "Arcon" system, trunking, wiring, reflectors and lamps, was prefabricated and wired-up on the floor of the sheds, and the complete assembly slung up to the roof trusses, connected to the mains—and switched on ! Obviously the method is not capable of indiscriminate application, but it certainly possesses considerable scope.

Transport Lighting

The first post-war rolling stock for use on London Transport's surface trains are now going into service on the District line. One hundred and forty-three new and eighty-two converted coaches are being brought into use, and one of the most important innovations is the provision of fluorescent lighting,

The first-class dining saloon on the Queen of Bermuda lighted over most of its area by warm white and gold cold cathode tubes in cornices to give indirect illumination. Further tubing is fitted in a glazed cornice round the central well and in the laylight in the centre of the well ceiling. Supplementary tungsten lamps are enclosed in fittings glazed to ensure harmony between the tungsten lamps and the cold cathode lighting. Other tungsten lamps for window lighting are fitted in concealed silvered glass reflectors on special mountings.

(G.E.C. photograph).

hitherto used only experimentally on London Transport trains.

At the junction of the upper and lower ceilings in each car, 2 ft. fluorescent tubes are supported in special aluminium housings separated by spacers of similar length and profile to form a continuous line the length of the car. There are 24 tubes in each car, operated in parallel from a 110-volt A.C. supply. Resonant starting is employed, and the control gear is mounted in the roof space on the back of the lamp fitting being accessible when the latter is swung open by the release of a concealed lock. To maintain an approximately constant voltage irrespective of the number of tubes operating, a series capacitor is provided together with a parallel capacitor for power factor correction. The only tungsten filament lighting in the coaches is over the communicating doors at the ends where there is a total of four 50-volt 45-watt lamps mounted in pairs in translucent glass fittings. These lamps, fed from the battery which normally floats across the terminals of the D.C. generator, for the sake of simplicity are alight whenever the car lighting is switched on.

A further installation of fluorescent lighting on public transport is on a Green Line double-decker bus, which uses nine interior fittings, each containing an 18-in. 15-watt warm-white lamp, with a 2-ft. 20-watt lamp in the front and rear indicator panels. Energy is through a 400-cycle invertor from the 24-volt battery. The invertor weighs 13 lb.

Of the lighting installations in new liners reported during the year, probably the most significant is in that of s.s. Caronia. Both forward and after restaurants contain indirect lighting illuminating panelling, but the tables are lighted from tungsten lamp fittings set in the "deckhead" (ceiling). Private dining-rooms use fluorescent lamps for direct and indirect lighting together with tungsten lamps. In the first- and cabin-class lounges the mixture is continued, whilst in the garden lounges concealed fluorescent lighting along the perimeter blends with fluorescent and tungsten in the main area to simulate sunlight. Perhaps undeservedly, fluorescent lighting is unpopular for social occasions. By providing a blend in all public rooms, maybe the Caronia has got something.

A similar trend is noted in s.s. Queen of Bermuda, where tungsten lighting is blended with cold-cathode fluorescent lighting in most of her public rooms. Similar remarks apply to the new m.v. Rangitoto. We note that the t.s.s. Orcades uses undiluted fluorescent lighting.

Other Applications

The new lighting in Beverley Minster is an example of the satisfactory use of bare fluorescent lamps. It is not always appreciated by the responsible authorities that for most ancient buildings modern oil lamps are just as much an anachronism as the latest gothic electric ones, and that the only illuminant the builders had in mind was daylight, with candles, perhaps, for the night. Consequently, to provide artificial illumination for such a building must mean normally either general lighting as in daylight, or strictly local sources of low output.

The double row of clustered pillars in the Minster, each composed of an assemblage of long and slender shafts rising from the ground to the spring of the aisle arches, were particularly suited for nesting fluorescent tubes in the recesses between the individual columns of each cluster.

In the report of the new installation of fluorescent lighting at the Institution of Electrical Engineers it was stated that the intensity in the theatre is limited to a maximum of about 6 lumens per square foot, as a higher level would have resulted in excessive brightness contrast. If this is correct, it is time the Institution removed this disability. It is incredible that a body which represents the power industry of the country should have the maximum brightness of its main apartment limited to a figure which would scarcely pass the factory bye-laws and certainly would not satisfy the Schools Inspector.

The prototype bookstall of W. H. Smith at Marylebone Station is a welcome example of the integration of the lighting equipment with an overall design, instead of being, and looking, a regrettably necessary afterthought.

The lighting of the "Young Liberty Shop" of Liberty and Co. in Regent-street achieves its aim of a soft feminine atmosphere, but it certainly demonstrates the lack of "punch" which the absence of spotlights involves, and to which we referred when describing the introduction of the internally silvered lamp.

In the "Evening News" West End office at the other end of Regent-street is a counter-demonstration of this very point. Fourteen internally silvered lamps in spotlights over the counter give a vital punch to

Interior of the Beverley Minster at night lighted by means of bare fluorescent lamps mounted on the pillars as shown.

W. H. Smith's prototype bookstall at Marylebone Station. Light is reflected down from the underside of the projecting fascia canopy through fins on to the counter line most effectively.

(Siemens' photograph).

the otherwise flat illumination of the general fluorescent lighting. To enter is to gain the impression at once of an alert and efficient office.

The Minister of Fuel and Power announced the lifting of the ban on display lighting only a fortnight before he made it operative, and it is a tribute to the enterprise of Messrs. Lennards, and a measure of their appreciation of the value of this part of their advertising arrangements, that the relighting of the windows of all their 120-odd shoe shops was carried out within that time. It is also an example of good staff work on the part of the manufacturers who undertook and succeeded in supplying the equipment and supervising its installation during those two weeks.

The fluorescent lighting on the "quarter-deck" of the Royal Naval College at Dartmouth is a worthy example of the adaptation of fluorescent fittings design to traditional architecture. The lanterns are similar to the poop-lanterns used for station keeping in old-time ships of the line, but accommodate six or twelve, according to size, 30- or

A section of the premises of Liberty and Co., of Regent-street, showing the use of indirect lighting to produce a modern atmosphere.

20-watt fluorescent lamps. Lanterns of similar design to take 200-watt tungsten lamps are used on the terrace of the college.

The floodlighting there is noteworthy, as both red and yellow are used, superimposed, on the red brick and stone-faced frontage, the yellow serving to eliminate on the stone the pink tinge from the neon.

The Brabazon hangar lighting appears to have raised some original lighting problems, in common with most operations connected with this biggest-ever aircraft. The 428 lighting clusters, using "Holophane" prismatic reflectors with a total connected load of 1,175 kw., are mounted 75 ft. above floor level and provide a service illumination of 20 ft.c. (lumens per square foot if you insist) as well as a reasonable upward intensity to illuminate the catwalks among the rafters.

The new fluorescent lighting in the Peace Memorial Hospital at Watford introduces a novel development. The wall fittings over the heads of the beds provide indirect and/or local direct illumination. Whether indirect lighting is best for a hospital ward may be debated, since the reclining patients often have the ceiling in their normal line of vision. Probably it is not worse in this respect than the light sources of conventional general lighting.

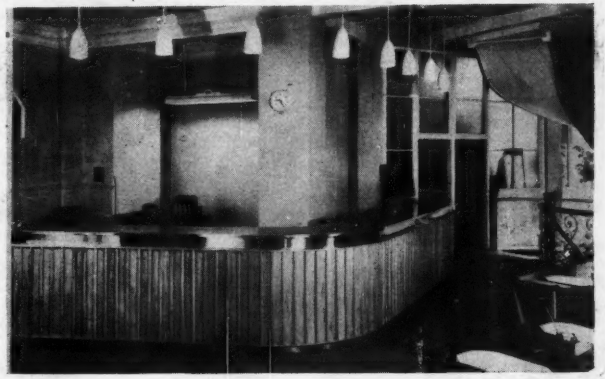
The business man who complained that his new office was lighted poorly when in fact the intensity was 40 per cent. more than in his old office, was misled because the new light was less obtrusive than the old. It is well to bear in mind that it is possible for a lighting scheme to be too good. Lighting is a combination of art and science and, like Justice, good lighting must not only be good but must appear to be so too.

One of the few locations where the colour of fluorescent lighting is very definitely preferred to that of tungsten lamps is in coal mines, and developments which have occurred in coal mine lighting in post-war years are remarkable indeed. The appointment by the National Coal Board of a lighting engineer at headquarters is a measure of the importance attached to it.

Empire and Foreign Notes

The Norwegian Lighting Development Association appears to perform many functions which are outside the scope of the Illuminating Engineering Society. Besides acting in an advisory capacity to its members in drawing up plans for lighting installations, a service it fulfils apparently because qualified lighting engineers are rare birds in Norway, it has organised also a central pool whence light-meters may be borrowed in view of the fact that these instruments are as rare as the lighting engineers. Its activities enjoy official recognition to the extent that factory inspectors are instructing industrial organisations to seek the association's advice regarding their lighting problems. The association has asked the Norwegian Government Department concerned to revise existing building regulations to allow rooms without natural lighting to be used as workrooms. It arranges courses on lighting and holds meetings on lines parallel to our own society.

As our personal knowledge of lighting in Russia is limited to trips to Archangel in 1941 escorting convoys, we read with interest the translation of B. F. Federov's "Lighting Technique." In 1941 such lighting as we were able to observe could only



The Regent-street offices of "The Evening News," showing the use of spotlights accommodating 150-watt internally silvered lamps to give emphasis to lighting on the counter.

(Courtney Pope (Electrical) Ltd. photograph)

be described as adequate but primitive and after reading Professor Fedorov's book, excellently translated by W. R. Stoker with additional sections by W. O'Dea, we see little reason to revise this opinion for the present.

The re-lighting of the old church of St. Paul in Frankfurt has been carried out in a typically German manner. When it was done in 1946/47 the building was not necessarily to be used as a church, and the large elliptical hall is lighted by bare tubular lamps mounted in vertical lines of ten lamps one above the other, running from the 70 ft. high ceiling down to about 10 ft. above the floor. By switching varying sequences the apparent size and height of the hall can be altered. With the lower

Interior of the Brabazon assembly hall at night showing the high bay lighting.

(Holophane Ltd. photograph.)

lamps alight a low ceilinged room of intimate proportions is said to be simulated, with the upper tiers only switched on the occupants are said to feel dwarfed, and with all lights blazing a festive carnival appearance is claimed.

Although Paris was the home of neon signs she had no supply regulation requiring a minimum power-factor. Shut off from low-tension fluorescent lighting developments, the end of the war found the city with a very heavy connected load of cold cathode lighting, the uncorrected high-voltage of which led to complications with the ripple control system. Accordingly, new regulations issued during the year by Electricité de France require, with certain qualifications, that from the beginning of 1951 all installations shall have a power-factor between 90 per cent. and unity, leading or lagging.

Estimated production of fluorescent lamps in France for 1949 was 1,200,000 hot cathode lamps and 700,000 metres of cold cathode tubing. New plant coming into production is expected to increase the 1950 output to 2,500,000 hot cathode lamps, but no increase is anticipated in the cold cathode figure.

Colour and Decoration

The demonstration offices which the Ministry of Works has established should provide valuable data in the course of time. It is noted that due regard has been paid to the lighting and we look forward to an interesting report when the experiment has been running long enough for conclusions to be drawn.

A three-day conference on Colour and Lighting in Factories held at the R.I.B.A. and arranged by the Council of Industrial Design, the British Colour Council and the Building and Paint Research Stations of the D.S.I.R., is a measure of the importance with which this subject is invested to-day.

Natural Lighting

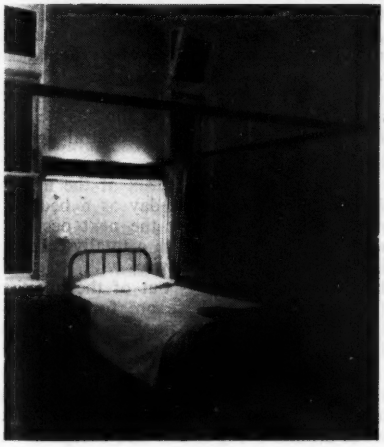
Mr. Petherbridge's article on "Recent Developments in Natural Lighting" does not deal, as one might suppose from the title, with developments in the light we receive from the sun, but developments in our use of it. Apart from the title it is an admirable article and an ideal guide to the

subject for those too busy, or too lazy, to study the report of the Lighting Committee of the Building Research Board on the matter.

Natural lighting in schools and other buildings has received considerable attention during the past year or so by both lighting engineers and architects. Though isolated instances of this work have come to notice (we recall the article by Mr. C. G. Stillman, the Middlesex County Architect, in the November issue of LIGHT AND LIGHTING), we feel that there should by now be much more detailed information available which we hope will be made known during the current year.

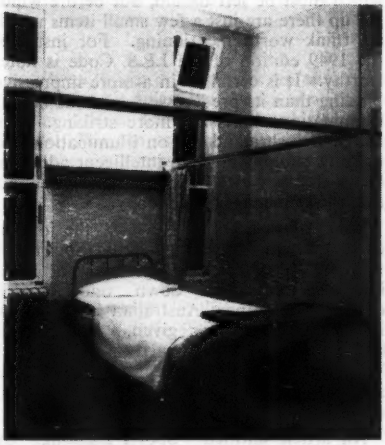
Ophthalmological Matters

An article by Mr. Ruff on "Fluorescent Lamp Radiations" reminds us that an impression seems firmly to be fixed in the public mind that in certain undefined circumstances fluorescent lighting can be harmful. The Borough Medical Officer of Health who inquired in all seriousness whether it caused sterility and the "Big Business Man" who considered it too hot were both victims of this heresy. It is understandable when we remember the warnings about the uninformed use of ultra-violet ray apparatus. To the uninitiated ultra-violet rays are ultra-violet rays and to talk of different wavelengths of them is mere quibbling.



H. C. Weston's new book, "Light Sight and Efficiency," describes first the physical bases of sight, then proceeds to methods of correction, not to restore the subnormally sighted to normal vision but to raise the normally sighted worker to super-sensitive vision to aid his work. The twenty-third Ettles Memorial lecture, "Methods of Facilitating Visual Tasks," reported in a recent issue of LIGHT AND LIGHTING is largely taken from this book. We note with interest that Mr. Weston goes to the Greeks alike for his vocabulary and his philosophy. An original and instructive volume for the lighting engineer.

Until fluorescent lamps arrived electricity was kept in its place. It entered the lamp through a contact, travelled primly along the filament and emerged at the other contact; but with fluorescent lamps it runs through all sorts of devices connected both in series and in parallel with the lamp, which itself has four contacts, two filaments, and no apparent connection between its two ends—and nobody really knows exactly what happens inside it! Hence the mistrust of the general public.



Showing the use of bed-head lighting as installed at the Peace Memorial Hospital, Watford, in which the light can be controlled upward or downward by the patient.

(B.T.H. photograph.)

The note in this journal on the illumination of the Snellen Chart calls for further inquiry by someone, though not perhaps by the I.E.S. If in fact a man can pass a test by the chart in daylight which he would fail by artificial light, and the prescribed conditions of use permit either illuminant, it is

obvious either that some are passed who should fail or some fail whose true standard is satisfactory; and such a state of affairs is *not* satisfactory.

Research on eye movements being conducted by Dr. Mary Lloyd and Dr. Wright at the Imperial College of Science is filling what we believe to be a complete gap in our scientific knowledge.

Miscellaneous

In a review of this nature there is much which must be left unsaid, but before winding up there are just a few small items which we think worth mentioning. For instance, the 1949 edition of the I.E.S. Code is noteworthy. It is certainly in a more impressive binding than its predecessors, and the colour illumination charts are more striking. The list of British standards on illumination and lighting equipment is an intelligent addition. We wish every electrical contractor, architect and works manager had a copy.

The "I.E.S. Lighting Review," the journal of the Illuminating Engineering Society of Australia, provides a lively review of lighting developments "down under." In descriptions of new Australian installations, intensities are always given. Will contributors to LIGHT AND LIGHTING please note! Without knowledge of the intensity provided and other relevant factors it is impossible to assess the effectiveness of an installation.

An article entitled "Sports Lighting," by D. E. Beard (LIGHT AND LIGHTING, June, 1949), we consider to be one of the most practical we have read on the subject. Short but lucid, it is comprehensive enough to cover the main sports of the country and brave enough to propose methods of lighting using fluorescent lamps. We wonder why in table tennis no stroboscopic effects were detected in installations above 55 ft.c., although below this intensity flicker was observed in high-speed play. Perhaps our ophthalmological members can elucidate!

In his Presidential Address to the I.E.S., Dr. Aldington referred to the need for an improvement in home lighting as one of the most urgent problems facing the Society, a statement endorsed by the well-known ophthalmologist, Dr. Wellwood Ferguson, when proposing a vote of thanks to the President. How wise is Dr. Aldington to bring us face-to-face with this unpleasant fact, for fact undoubtedly it is, and unpleasant it must be held to be, since the way to correct it is not easy. Let us examine the basic situation. Two hundred years ago, rooms were lighted, if the occupants could afford it, by chandeliers; in effect, a very large light source of low surface-brightness, and these chandeliers were supplemented by local lighting in the form of candelabra or candlesticks where the use of the room required it. A hundred years later the twenty candles in the chandelier had given way to half a dozen fishtail gas-burners suspended from the same point, and, incidentally, still called a chandelier, but candelabra or candlesticks were still used on the sidetables and armchairs to provide local lighting to read or write. To-day, a hundred years later still, the gas-burners have given way to electric lamps at the same point, but, generally speaking, the local lighting has disappeared. There are many superficial reasons which can be said to explain this: that with to-day's lighting the intensity on the sidetables from the central light is higher than it was even with the candelabra, and so on; but such claims confuse good lighting with adequate intensity, presuppose shadows to be invisible and the requirements of a factory to be synonymous with the refinements of a home. In other words, we cannot obtain reasonable standards of domestic lighting as long as we continue to depend on a single central lighting point in each room.

This brings us to the crux of the matter, for the room we use to-day as a bedroom may well be wanted by the next occupant of our flat as a study with a totally different lighting lay-out. To rewire, with its corollary of redecorating, is out of the question for most of us, and we are forced to fall back on the remedy of floor and desk lights fed through flexible leads.

Our friends in the Institution on the Embankment, groping in their 6 ft.c., thunder against the encouragement of trailing live wires around living-rooms but, except to the millionaire, that is the solution to-day. However the theoretical argument may run, are these lengths of live flex so dangerous, after all? In 1939 alone one supply authority which shall be nameless sold 200 cheap 300/500-watt semi-indirect floor standards in an old-fashioned part of its area, where conversion to modern permanently wired lighting was not feasible without costly redecorating; and there are no reports yet of holocausts resulting from worn-out flexes. On the contrary, the domestic upheavals which have been nipped in the bud by the diminished eyestrain cannot be told with certainty but must have totalled a goodly number.

Darkness Into Daylight

The following is a summary of a public lecture given by Dr. J. N. Aldington, President of the I.E.S., at the Philharmonic Hall, Liverpool, on January 26th, 1950.

Dr. Aldington's lectures on this subject are well known, and the lecture at Liverpool was the last of a series which he has given in many parts of the country including Preston, Manchester, Newcastle and Sheffield. All of these lectures have been public, the audience varying from 1,600—3,000. The substance of the lecture is as follows.

In 1808 Sir Humphry Davy demonstrated the electric arc before the Royal Institution in London, and 70 years later Sir Joseph Swan produced the carbon filament lamp in a practical form. From these early beginnings have come a host of major inventions and a highly scientific industry which, by giving to man electric lamps of every form and kind, have probably contributed more to human welfare and human happiness than any other single branch of endeavour.

Development of the tiny lamps which enable the surgeon to examine deep into the human body or of the powerful sources which produce the lighthouse beam has not occurred by chance but has resulted from years of patient work in the large research laboratories created and maintained by the leading members of the industry. To trace the history of even a single development in the ever-progressing field of lamp research would require more space than can be allotted to the present account, to do it justice would require a book. It is therefore intended to indicate only the broad lines along which progress has been made and success achieved in the constant search for new and better sources of light. In surveying the course of development over about the last one hundred years and, in particular, the remarkable progress which has been made in the twentieth century, we can trace the influence of both pure and applied research. We can see how from time to time advantage has been taken of the general advance of knowledge to divert the course of an investigation and to enable a forward step to be made. We can see, too, how investigations into the properties of transparent materials such as glass and quartz, refractory metals such as tantalum, molybdenum, and tungsten, and rare gases such as argon, neon, and krypton have contributed to the evolutionary process from which have emerged the many different forms of electric lamp upon which the industrial, domestic, and social life of our country so much depend.

The primary process by which electricity is converted into light is the passage of an electric current through either a wire, which is thereby raised to a white heat, or through a gas which either glows itself or produces radiation which causes the glow of a fluorescent powder. We will examine these various methods separately.

The Incandescent Lamp

Even before the time of Swan, numerous experiments were carried out both in this country and elsewhere to make use of the light produced when a conductor was heated to incandescence by the passage of an electric current. Filaments of platinum, iridium and other materials were tried in turn. The early work was handicapped and often frustrated by the lack of a steady source of electrical energy but, as means for producing electricity on a commercial scale were evolved, progress became increasingly rapid. Swan in England and Edison in America, working independently, announced practically at the same time the successful development of the carbon filament lamp. In Swan's lamp the filament was made by carbonising a cellulose fibre similar to that of artificial silk. It was mounted in a glass bulb, which was subsequently exhausted of air. It was

soon recognised that improvements in the main would come about by the development of more refractory filaments capable of being heated to a higher temperature for a longer time. A metal was the obvious choice, and in turn the properties of all the likely substances were examined and means were sought for producing strong, long-lasting filaments of elements such as osmium, tantalum, and finally tungsten. The osmium lamp was noteworthy because it was the first filament lamp in which a thin wire was produced by pressing the powdered metal through a die, a process which undoubtedly influenced later work. The tantalum lamp, upon the development of which vast sums of money were expended, enjoyed a well deserved success in the early years of this century as the first ductile metal filament lamp. It gave place about the time of the first world war to the drawn wire tungsten lamp, which is now produced in hundreds of different forms and for unnumbered purposes.

Before leaving the story of the incandescent lamp it is perhaps opportune to refer, however inadequately, to another aspect of lamp research. Developments in other industries and in the science of lighting are constantly imposing on the lamp research engineer new requirements and demands. It may be that, notwithstanding the very comprehensive selection of incandescent lamps already available, some special purpose may require the production of a new or modified form. In dealing with this problem it may be necessary to consider the development of a new glass for the bulb capable of withstanding higher temperatures, or new hermetic seals to lead the current-carrying wires from the lamp cap through the glass to the filament. A more compact filament may become necessary or some special conditions of use may demand a lamp which will withstand considerable vibration and shock. An interesting example is the case of the miners' lamp. Two main types of portable lamp are used by the coal miner, both of which require special highly efficient electric lamp bulbs. In the cap lamp the bulb is mounted in a headpiece, and throws a beam of light directly in front of the miner while the hand-lamp gives an all-round flood of light for general purposes.

Obviously any improvement which would enable the production of more light for a given consumption of power from the portable battery would be a step forward of major importance. This forward step has now been made by the large-scale introduction of krypton-filled miners' bulbs developed in the lamp research laboratories of this country. Twenty per cent. more light is produced for a krypton-filled bulb compared with the earlier type. The development was made prior to 1939, but the war hindered progress, although many krypton bulbs were in use when war broke out. Since hostilities ended, however, more types of krypton-filled bulbs have been developed and a substantial contribution has been made to assisting the miner in his difficult task. To bring about this result, industrial plants had to be developed to extract krypton from the atmosphere in which it is present to the extent of only five parts in a million and new techniques of lamp manufacture had to be evolved to enable the employment of smaller lamp bulbs and brighter filaments.

Electric Discharge Lamps

It is tempting to digress and tell of other examples of research in the field of incandescent lamps, but we must turn now to a brief review of the second main batch of light source development which began with Davy's first arc. It was produced by touching together two pieces of charcoal which were connected to a powerful battery. Davy's own notes read as follows:—

"The charcoal became ignited to whiteness and, by withdrawing the points from each other, a constant discharge took place through the heated air in a space at least equal to four inches producing a most brilliant ascending arch of light, broad and conical in form in the middle." Modern forms of the carbon arc still find important uses, both in war and peace. They are the principal light sources employed for both film picture production and projection. But it is as the forerunner of the electric discharge lamp that we are primarily concerned with the arc in this review.

Parallel with the developments which have been described, investigations into the properties of glow and arc discharges through various gases and metallic vapours have been carried out for more than a hundred years. To-day, in this country alone, there are several major groups of research workers continuously engaged in the study of electric discharge phenomena. Their discoveries have not only enriched contemporary science and furthered man's knowledge of the structure of matter, but they have produced new types of lamp of great importance in the effort to turn night into day.

Early forms of electric discharge lamps,

including the mercury tube of Cooper Hewitt and the Moore carbon dioxide lamp, made their appearance at the beginning of this century, while various types of coloured high voltage sign tubes appeared on the market some 30 years or so ago. At a still later date fluorescent powders were developed in this country and applied to the inside walls of these high voltage tubes, thus greatly extending the range of available colours and, in some cases, producing notable improvements in the efficiency of light production.

All these tubes, however, were of comparatively low power and intensity, and their use was limited by the high voltage and long lengths to special and display purposes. About 1930 a step forward of the first importance was achieved with the development of the low voltage electron emissive cathode. It became immediately possible to produce short discharge lamps of high power and efficiency capable of operation from the normal electricity supply mains. The sodium lamp with its golden yellow light and the high pressure mercury lamp followed one another in quick succession. It is worthy of record that major contributions to the development of the many forms of mercury lamp have been made by British research workers. These lamps enabled greatly improved illumination to be provided in street and factory without increasing the running costs. They brought in their train new techniques of street lighting which have materially assisted towards the achievement of greater safety on the roads at night.

Fluorescent Lamps

Not only, however, was the electrical discharge through mercury vapour at high pressures found to yield visible light directly at efficiencies some three times those achieved with the filament lamp, it was also found at very low pressures to be the most efficient source of invisible ultra-violet radiation yet discovered.

This fact, together with the development of fluorescent powders of greatly improved efficiency, enabled the production of the modern mains voltage fluorescent lamp in which the primary discharge through mercury vapour at low pressure produces ultra-violet radiation. This is then transformed into visible light of daylight quality by the thin layer of fluorescent powder coated on the inside surface of the glass tubing. This statement, of course, over-simplifies the long story of research which gave the fluorescent lamp to the lighting world some 10 years ago. For it is a story of chemists seeking to perfect chemical compounds capable of fluorescing or glowing with the desired colour and quality of light. It is a story of physicists patiently investigating electrical discharges through rare gases and mercury vapour at low pressures. A story of literally thousands of experiments on electrodes and tube dimensions carried out in lamp research laboratories both here and in America, an epic of many trials and disappointments but of eventual success.

Since the fluorescent lamp was launched on the British market at the beginning of the war for the essential task of lighting factories, some totally blacked out and some without windows at all, new chapters have been written in the story of another culminating piece of applied research. The efficiency of the fluorescent lamp has been increased by 50 per cent. since it was first introduced and it now gives about four times as much light as that emitted by a filament lamp consuming the same electrical energy. It is being introduced in new sizes as its field of usefulness extends. "Daylight" has been brought into the coal mine by its application at the coal face. Aircraft of the King's Flight were equipped with fluorescent lamps for the South African tour and flourescent lighting was installed in the royal train. It is being tried for train and tram and 'bus lighting. It has enabled new levels of illumination to be achieved in both factory and store and thereby has contributed to improvements in the efficiency of industrial processes as well as to the amenities of life both by day and by night.

On January 1, 1950, as a result of continuous research into fluorescent powders and investigations of the best colour-rendering effects for various purposes, a new fluorescent lamp was introduced with a colour described as "Mellow." It is admirable for use in domestic premises, commercial establishments and restaurants. The colour-rendering of most articles of food is excellent under the light of the new lamp and its introduction marks a new step forward in the aesthetics of lighting practice.

By successive developments since it was first introduced the fluorescent lamp is now available in a form which closely simulates natural daylight for colour matching in three variants of daylight and in the new "Mellow" form which still further widens its effective field of application. It is one of the most efficient sources of coloured light and practically every hue of the rainbow can be simulated. It has proved admirable for

road lighting and in this matter this country has given a lead to the world. While other forms of lamp are still under development and much remains to be done, the fluorescent lamp is the nearest approach to cold light which has so far emerged from the lamp research laboratories.

The lecture was illustrated by a number of demonstrations including a 5 kw. lighthouse lamp of novel design, the effect of colour fatigue on the eyes of the audience, a demonstration of flash discharges, the 5 kw. xenon gas arc lamp and the new "Mellow" fluorescent lamps.

Among those present were the Lord Mayor and Lady Mayoress of Liverpool, Mr. J. Eccles, chairman of the Merseyside and North Wales Electricity Board together with other members of the Board, representatives from the University of Liverpool as well as members of the general public.

The lecture was held under the auspices of the Electrical Contractors' Association, the Electrical Wholesalers' Federation, the Lighting Service Bureau (Local Advisory Committee), the Illuminating Engineering Society, and the Merseyside and North Wales Electricity Board.

Correspondence

Lighting Units

To The Editor of LIGHT AND LIGHTING

Sir,—While sharing your correspondents' dislike of the cumbersome expression "lumens per square foot," surely it is more intelligible than "foot-candles." All that is necessary is that an acceptable name, preferably as short and euphonious as "lux," should be found for the unit of illumination. Several suggestions have appeared in your columns from time to time, but apparently none has secured any supporters. May I add one more, albeit in the sure and certain belief that it will share the fate of its predecessors? It is "lura," i.e., "lu" for "lumen" or "lumens," "r" for "received" and "a" for "per unit area."

As for the "iso-lumens-per-square-foot-diagrammers" Mr. Martin Gaughan refers to, why should not they be "iso-illumination-diagrammers," if Mr. Gaughan would not have them drawers of "iso-lura" diagrams?

No longer let us hyphen the foot to the candle, nor (curiouser and curiouser) to the lambert! Up the rational-terminology-ists!—Yours, etc.,

"DIMMERWIT."

London.

Fluorescent Lamp and Circuit Test Set

Testing fluorescent lamps and gear without disturbing installed wiring, or having to take readings in awkward positions, is made easy by a new Osram test set introduced by the General Electric Co., Ltd. The set is contained in a black metal case with carrying handle, measuring 9 in. x 4½ in. x 6 in., and

Lamp and circuit test set.

is supplied with a set of leads for connection to fittings with different types of starters. An extension lead is provided for use with any of the foregoing connectors, and a length of flex is permanently connected to the set so that readings can be taken on a universal volt-ampere meter, such as the G.E.C. "Selectest."

By means of this set, tests of mains volts, lamp volts, starting current and running current can be made without any alteration of connections. The test set also provides a convenient means of checking the operation of starter switches.

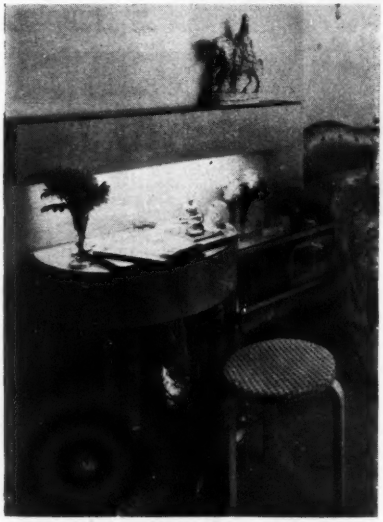
An instruction handbook is issued with each set. Tables of operating characteristics of the standard sizes of fluorescent lamps and the catalogue numbers of G.E.C. gear for the various circuits and main voltages are included. A description of the test set was given in a recent paper to the I.E.S. by Mr. W. A. R. Stoyle and Mr. G. D. Jones-Thomas.

Home Lighting.

The Progressive Idea

Lighting in the home is a subject in which we are all interested. This is the first of a series of articles intended to show what can be done with light in the home without undue expenditure.

Observation of a boiling kettle, as every child has learned at someone's knee, was the inspiration for the steam engine, and if the separate inspirations for the bulk of our present-day amenities could be lined up we should no doubt find ourselves with as unlikely a collection of bits and pieces as we could wish to see. And yet between each and the modern object which has developed from it there would stretch one common line, the line of progressive thought and progressive development. In other words, in every case progress has resulted from a person or a group of people exerting their minds to see further possibilities in each new stage of progress. Men of exceptional ingenuity they may have been or be; unusual men, perhaps, but surely men with a turn of mind worth emulating and a turn of mind which every one can emulate if the will to do so be there.



A pelmet dropped from a mantelshelf above a disused fireplace screens the light above this built-in writing table.

To-day, however, amongst a very large percentage of the community, progressive thought seems to have given way to the carbon-copy mind, with the result that on all sides are to be seen examples of good ideas misapplied to such an extent that they make no sense at all, or the embryos of good ideas applied crudely and without any realisation of what, correctly nurtured, they might so easily become.

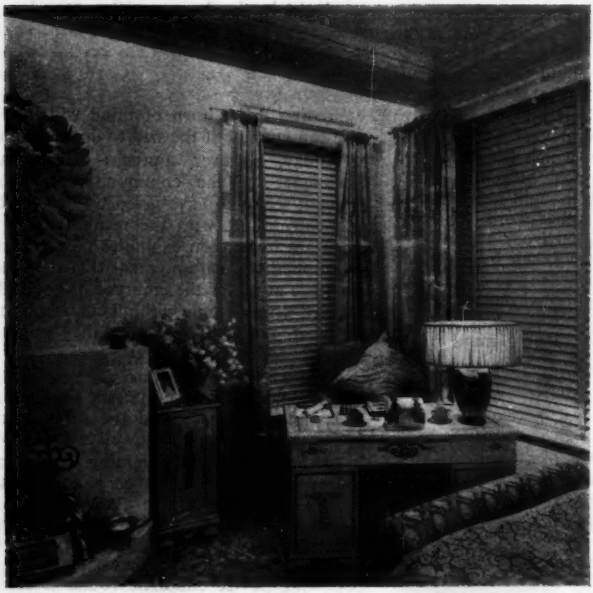
Hardly anywhere is this spineless attitude more apparent than in domestic lighting, and it is not difficult to find the reason, or at least a reason, which may well account for it.

In the early days of lighting development there was a universal tendency, and one that still dies hard to-day, to attach labels. A glance through almost any promotional publication of a quarter of a century ago will illustrate the point. In one such book the following advice could be found under the heading "The Hall"—"An atmosphere of welcome and warmth can be created by the use of flame-sprayed lamps." Or, again, under "Lounge," it was stated that "An illuminated niche lends a note of distinction and originality . . . while window curtains can be greatly enriched if lighted by coloured lamps from the pelmet." Thus flame-sprayed lamps were labelled "Hall" and niches and curtains labelled "Lounge," as much as to suggest that, used elsewhere, they would be wrong. The desire to take the *idea* of lighted curtains and adapt it or apply it where most suitable was indirectly, although probably quite unintentionally, discouraged. Is it then any wonder that a generation has grown up which thinks of different forms of lighting as applying directly to specific locations,

and is, indeed, a little hurt if it should be asked to look beyond its nose?

The type of lighting promotion, however, which has led to this outlook is now obsolete, and the death of the mode of thought that it has promoted is long overdue. The technique to-day in dealing with domestic lighting should be to put forward ideas, ideas as varied and numerous as possible and leave it to the individual or, rather, compel the individual to use his own brain in applying them.

The simple pelmet is a case in point. Normally a pelmet is used for hiding a curtain rod or rail, but used as a baffle or shield for concealing lighting its applications are immensely varied. Attached to the ceiling a few inches from a wall, it can provide screening for a downward flood of light. As a projecting board in the usual curtain-rail position, it can be left open top and bottom for lighting both curtain and ceiling. Mount it on a wall at eye level and it can again perform a dual lighting function. Attached to the edge of bookshelves, it will conceal tubular lighting for downward illumination on the backs of books, or, attached to edges of glass shelves, it can provide delightful china- or glass-cabinet lighting. It lends itself to bed-head lighting or, mounted a foot or so from the floor, and enclosed at the top, can provide excellent pilot lighting for a small child's bedroom, a sickroom or for televiewing. Mounted above a wall desk or writing table and concealing a fluorescent lamp, it can produce admirable local lighting, whilst out of doors it can be used for illuminated window-boxes, sunblinds, flowerbeds, and so on. All these ideas spring from the one original idea of concealing a lamp behind a curtain pelmet for illuminating the curtains. It may be argued in many cases that it has ceased to be a pelmet and should be called by some other name, but it does not alter the main point—progressive thought has been applied to one single idea producing many others.



An existing beam used as a pelmet for concealing two 5-ft fluorescent lamps.

Nearly every lighting idea can be treated in a similarly productive way, and when this is realised, it is immediately apparent how much is being missed by those who will not think progressively or beyond the actual examples of an application with which they are familiar.

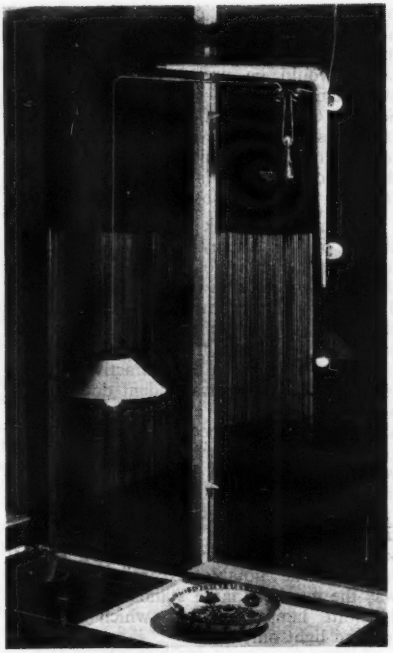
This applies not only to lighting but to all new materials in general. Away with regimentation and forward with the progressive and imaginative ideas which lead to individuality in home planning!

European Lighting Fittings

An exhibition of representative lighting fittings from a number of European countries was recently held in Glasgow. The following is a brief description of some of the exhibits.

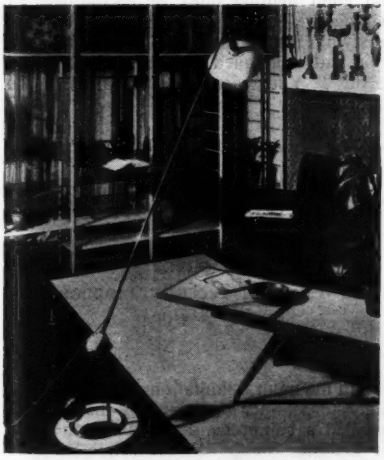
Your correspondent visited the Exhibition of European Lighting Fittings* in the hope that he might see some new departures and original ideas. Certainly originality (in application, if not in ideas) was not wanting, and the exhibition was refreshing.

The scheme of the display offered great scope for the designers, Robert and Roger Nicholson, who must be congratulated on having made even the most unwieldy lighting contraptions seem "at home." In order to do this we were treated to displays of bric-à-brac, old china, succulent plants and modern furniture.



Italian wall fitting finished in polished walnut and brass.

* Council of Industrial Design, Scottish Committee, Exhibition of European Lighting Fittings. Messrs. Wylie and Lochheads, Buchanan-street, Glasgow. January 24—February 14, 1950.



Italian brass standard which is weighted with a brass ball at the end and pivots on a second ball about one foot from the end. The shade swivels independently.

We were told that the designs represented "some of the best lighting fittings from the Continent," and there is no doubt that in most cases the lighting results were passable. It is significant that the terms "pretty" and "elegant" were commonly applied by observers. The workmanship of the few British fittings was superior to that of most of the foreign productions; in particular a beautiful (and effective) version of the famous B.S. Study Lamp in wood and copper-coloured anodised aluminium deserves special mention. That only a very few British examples were selected is a challenge to our industry to produce new good designs and, at the same time, is a confession that we are not at present generally producing lighting equipment up to the aesthetic standard set by the Council of Industrial Design.

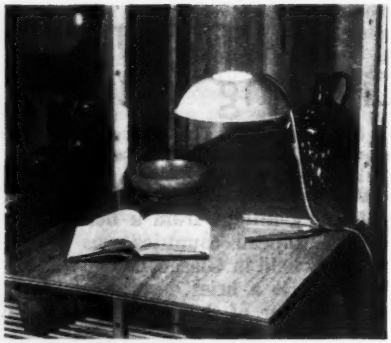
As all the various fittings shown had, if

not a purely domestic application, at least a domestic flavour, the entire absence of any fitting designed to take fluorescent tubular lamps would be understandable, but Mr. Wyndham Goodden (Chief Officer of the Scottish Committee of the Council of Industrial Design) pointed out that he had intended to show in this sphere three British designs of merit; it is to be regretted that this was not found possible.

It is useful to look at the general trends shown by the display—the sound principle in domestic lighting of bringing the light to the work was seen in almost every example. The use of grossly impractical materials for shades (where these are not metal) was equally obvious—the rough fabrics used by one group (Swedish) are attractive in their texture but your correspondent doubts their ability to withstand exposure to Glasgow atmosphere without becoming shabby. From a purely technical point of view, the low wattages of tungsten lamps for which the fittings were designed would appear to have relegated most of the lamps to a decorative role. (The minds of Continental makers seem from this display to be set on 15-watt lamps. One notable exception, however, was the excellent large standard, with three 100-watt lamps, one of which was for upward light only.)

The ingenuity of the designers—particularly the Italians—is unquestionably their strong point, but the result is frequently to produce merely a vehicle for carrying a lamp, with no pretence at a device for controlling or shielding the bright light source. Not one louvred fitting was exhibited.

Obvious features common to most of the



Danish table standard in brass with white enamelled metal shade. There is a round glass inset on top of the shade.

designs shown are the clean lines and attractive use of natural materials; unbleached linen, wood polished but not stained, brass merely lacquered and not plated, spun glass—even plain white paper, straw and grasses . . . all have been used to good effect.

Two worthwhile lessons to British industry emerge from this mountain in labour. There would seem to be a call for simple, well-proportioned paper shades similar to the Danish example, and sold at throw-away prices to fit on to permanent wire frames; and good lighting must be encouraged by making well-thought-out and aesthetically-satisfying fittings no more expensive than their badly designed competitors. How to do this? Your correspondent passes on the challenge.

A Lighting Demonstration Room

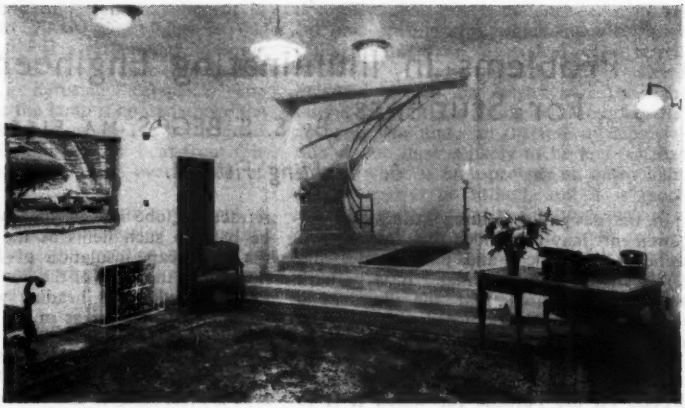
The new Holophane showroom in London, recently reopened.

The new Holophane demonstration room at Elverton-street, Westminster, is a progressive development of the company's established policy of designing and marketing the Holophane system of lighting on an illuminating engineering basis.

An enquiry for lighting equipment is primarily influenced by the desire for adequate and suitable artificial illumination, the requirements of which cannot be satisfied by the simple procedure of selecting a particular type of lighting unit in a showroom display.

Within the natural limitations imposed by the dimensions and proportions of the room is installed a comprehensive installation offering facilities for the demonstration of some of the alternative systems of lighting having particular characteristics suitable for specific application.

The room serves the two-fold purpose of



(Left). The reception room.

(Below). The demonstration room, showing the built-in cabinets and the ceiling fittings.

demonstrating the principles of scientific light control embodied in the Holophane system of lighting and its wide ranges of applications in every field of lighting practice. Cabinets, built into the wall, have been equipped with apparatus to demonstrate the efficient and accurate light control afforded by typical Holophane prismatic units.

The ceiling demonstration equipment has been arranged to provide suitable demonstrations of alternative systems, both in regard to their distribution characteristics and application to specific types of interiors. Each system embodies a group of four or six fittings of similar type, mounted at suitable height and spacing, in order that the performance of such a system can be appreciated under service conditions.

The wide range of fittings exhibited covers industrial reflectors of the metal covered and enclosed translucent types, flame-proof, vapour-proof and bulkhead units, flood-lighting and street-lighting equipment, commercial pendants and in-built lighting units for almost all applications. Fluorescent surface and in-built systems are also included so that the relative merits of both systems can be readily assessed.

Problems in Illuminating Engineering For Students

By S. S. BEGGS, M.A., F.I.E.S.

6. Lighting Fittings.

In the design of lighting fittings, the requirements may be divided broadly into two sections, (1) optical and photometric, and (2) mechanical and thermal. It is perhaps not always realised that the illuminating engineer is as much concerned with the latter as with the former.

The type of "optical system" to be incorporated in a lighting fitting will obviously depend on the purpose for which it is to be used. It is essential, therefore, that the use of the fitting should be analysed and the function it is required to perform should be carefully thought out before even the type of fitting is decided upon. The main considerations to be borne in mind are:—

(1) For general lighting, where the area is not restricted and hard shadows are undesirable, diffused light is most suitable. The fitting should make use of diffusing materials, and not be too small in size.

(2) For concentrating light on to a restricted area, or where a high degree of control of the light distribution is required (e.g., a spotlight, or in streetlighting), specular reflectors or prismatic refractors must be used. (A small amount of diffusion may be permitted.)

(3) If the light is required mainly in one direction, with none in the opposite direction, reflectors give the best control of the light. If the light is required mainly about two (or more) widely separated directions (e.g., nearly opposite directions), probably a refracting optical system will be preferable.

(4) To avoid glare, any part of a lighting fitting which may come within the normal field of view, either directly or by reflection, must have a low brightness.

The mechanical and thermal considerations include factors such as robustness, corrosion resistance, temperature of operation, ease of manufacture, and maintenance. In addition to the parts of the optical system—reflector, refractor globe or glazing—attention must be paid to such items as the lamp holder, the lamp cap, insulation of leads, gaskets, hinges and the body of the housing generally. Perhaps under this heading we might also include appropriateness of the design to the situation in which it will be used. These considerations will usually determine which of several alternative materials of a given type is most suitable and what form of fitting shall be used.

The actual ability to design good lighting fittings is in part a gift and in part a matter of training and experience. Much can be learned by studying the fittings met with in different situations in every-day life, for this reveals not only what to do, but sometimes—unfortunately—what not to do.

Question 10 (1946).

Sketch a range of fittings suitable for the 5-ft. fluorescent tube. Suggest the application for each type of fitting, and compare it with the tungsten lamp equivalent.

Answer

Tubular fluorescent lamps may be used for the majority of purposes for which tungsten filament lamps are used, the main exception being when a very high intensity is required over a small area—such as from a spotlight or optical projector—when the brightness of the source must be high. It is not possible to describe all the applications, but a short selection of some for interior lighting purposes are sketched in Fig. 4.

The first (Fig. 4(a)) is an open trough type of fitting, for industrial use. For use in workshops and the like, it may be made in sheet steel, with a good white stove-enamelled interior surface; vitreous enamelling may be used, but it presents difficulties in this length of fitting on account of warping of the metal sheet at the high temperature involved in the process. The reflector is detachable, for cleaning, without dismantling the fitting; the ends of the lamp (near the electrodes) are covered, as if they are visible a slight flicker is sometimes noticeable and may be objectionable. It is preferable to allow some of the light to

The first article in this series appeared in Vol. XLII, No. 9, September, 1949.

reach the ceiling, and slots may be cut in the reflector to allow some light to be emitted upwards. If a rather more decorative appearance to the fitting is required it may be made in diffusing "Perspex." The control gear for the lamp is housed above the reflector; provision must be made for good ventilation and dissipation of heat from this part of the fitting to avoid overheating of the gear.

The tungsten filament lamp equivalent is the circular vitreous-enamelled reflector, which is smaller, and simpler because of the absence of control gear. This does not give quite so much diffusion, but does provide a definite cut-off angle of the source in all directions (which is essential with the high brightness source). The equivalent of the plastic trough unit incorporates an opal glass globe inside the reflector.

A simple open unit, suitable for small offices and shops, is shown in Fig. 4(b). Provided the decorations of the room are light, the bare lamp has a low enough brightness for it not to be a source of glare, but it is preferable for it to be partially shielded by diffusing screens as shown. The side screens are translucent; the louvres (which are optional) are readily detached for maintenance.

The equivalent simple tungsten lamp unit is the translucent shade above the lamp, open below. The shade may be moulded in one piece or built up from panels. It is fairly satisfactory with pearl lamps, but is less satisfactory for higher wattage units; the fluorescent lamp has the advantage in this class of fitting.

For higher quality lighting, and of a more decorative character, is the enclosed cylindrical unit of Fig. 4(c), which may be either ceiling-mounted or suspended. The cover, which may very suitably be of fluted Perspex, ensures low brightness. The light output ratio of the fitting is lower than for an open type unit, but the rate of depreciation due to dust is likely to be less (so that after a while it may provide as much light as the open type fitting), and it is more appropriate to decorative interiors, such as a conference room, restaurant, bank, or departmental store. Plastic material has the advantage over glass of lightness, which is of significance where a large area of material is required.

The corresponding tungsten lamp fitting is the enclosed globe or box-type fitting, which is generally appreciably smaller in size. Plastic is not generally suitable because of the higher temperatures attained with filament lamps, and they are usually made of glass, which may be opal, figured, etched or tinted.

In shop-window lighting relatively high intensities of illumination are required, which demands a considerable degree of concentration of the light. The light cannot be controlled effectively in planes through the axis of the lamp, but a specular trough reflector, as shown in Fig. 4(d), provides a high degree of control in planes at right angles to the axis. Silvered glass is very suitable, on account of its high reflection factor, but if the reflector is large (e.g., in a multi-lamp unit) anodised aluminium may be used satisfactorily, with a saving in weight. If the sideways spread of light is too much, louvres may be added, but they

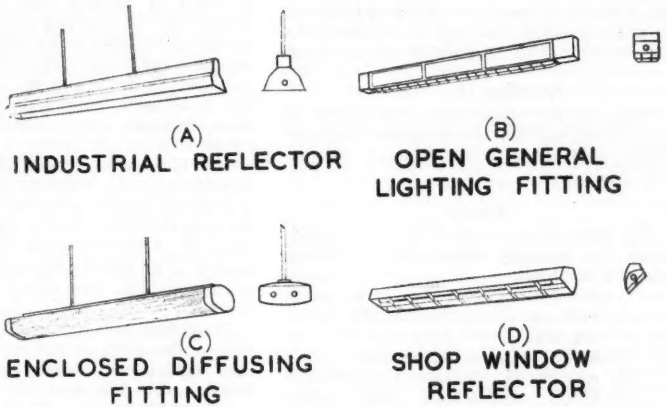


Fig. 4.
A range of interior lighting fittings for use with 5-ft. tubular fluorescent lamps.

should not be used unless necessary, as illumination values are reduced appreciably thereby.

For tungsten filament lamps a fluted silvered glass reflector of special shape is generally used, giving a high degree of control of the light distribution. The silvering has to be of high quality, because of the high temperature to which it is subjected. With the fluorescent lamp units filament lamp spotlights are often required in addition for picking out the main features of the display.

The range of designs is, of course, almost infinite, but the designs illustrated indicate the diversity of the types of fitting (diffusing or concentrating) that may be designed for use with the 5-ft. fluorescent tubular lamp.

Question 11 (1944)

What are the requirements for a table or study lamp, and how are these met in a good design? Sketch a polar curve of distribution from such a lamp.

Answer

The main requirements of a table or study lamp may be briefly listed under the following five headings:—

(1) Adequate general light in the room;
(2) Sufficient illumination on the "working area";
(3) Sufficient area illuminated;
(4) Absence of glare (direct or reflected);
(5) Good appearance and sound engineering design.

A table lamp, especially when used for study or reading, as distinct from additional lighting in a sitting-room, is often the only source of light in the room. For this reason it is undesirable that it should light only or mainly a limited area of the table, leaving the rest of the room in relative darkness. The power of the lamp should be sufficient to provide a low level of illumination in the room generally as well as adequate illumination of the reading matter. At least as much light should be directed upwards as on to the table.

A suitable design of fitting is shown in Fig. 5(a), and the light distribution it would provide is given in Fig. 5(b).

The general light can most effectively be provided by upward light from the lamp, which may be allowed to emerge directly, provided the lamp is not normally visible at ordinary eye level. The cut-off should be at about 45 deg. from the upward vertical, but a diffusing bulb and diffuse reflection from the shade help to avoid a definite hard cut-off line.

The illumination required on the table should be of the order of 10 lm./sq. ft. It will not be uniform, but the illumination on the page should not be less than this value. A lamp of about 100 watts rating will be required, if an electric filament lamp is used, or of equivalent light output with other light sources.

More than one person may wish to make use of the lamp at the same time, so the area lighted will usually be circular, and should not be less than 4 ft. in diameter. (If a tubular lamp is used the area may be rectangular, but should be of this general size.) To cover this area satisfactorily, the

(*Continued on page 76*)

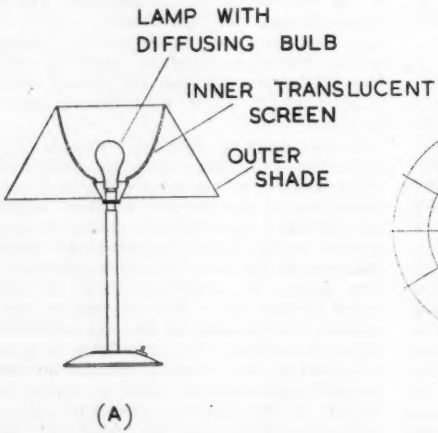


Fig. 5. Design and light distribution of a table lamp.

REVIEWS OF BOOKS

"Cold Cathode Fluorescent Lighting," by H. A. Miller. pp. 127 + *viii, with* 50 *illustions. Published by The Technical Press, Ltd.,* 1949. 10*s.* 6*d.*

The title of this book might perhaps be a little misleading to the lighting engineer as, strictly, only some 25 per cent. is concerned with lighting, and half of this refers to display lighting.

The book is perhaps best suited to the general reader who wishes to obtain a quick over-all picture of the sign and decorative lamp industry.

It deals mainly with the manufacture, operation and operating precautions, etc., of cold cathode electric discharge lamps, of which the fluorescent variety is an example.

In trying to cover the wide field of theoretical explanation, manufacture, operation and installation, in terms easily suited for the general reader, it suffers the lack of exactness which would satisfy a specialist in any of the branches described. In the opinion of the writer the descriptions of the fundamental properties of light and of electric discharges are so brief as to be more likely to confuse the reader than explain the subject. General statements of the advantages of the fluorescent tubing tend to get mixed into these fundamental descriptions.

The mixture of American and British data in connection with hot and cold cathode fluorescent lamps tends to be a little misleading. The lives and efficiencies of hot cathode lamps greatly exceed those mentioned.

It is interesting to note the author's opinion that the main permanent use of cold cathode fluorescent lighting is in the form of a decorative complement to the more economical mains voltage lamps. While his section on lighting installations using the lamps shows one or two interesting examples, it seems probable that the economic conditions of the last few years have rather prevented the author having further examples of this attractive use of the cold cathode fluorescent lamps. H. R. R.

"Electric Lamps." pp. 147, *with* 50 *photographs and* 57 *diagrams. Published by the Lighting Service Bureau, London,* 1949. 7*s.* 6*d.*

Electric lamp production is an outstanding example of an industry controlled at all its stages by scientific methods, from the mechanised blowing of the glass bulbs to the statistical examination of sales returns, and the uniformity and reliability of the lamps which we buy provide a justification for the elaborate controls and processes through which they have passed. The history of the incandescent electric lamp goes back over nearly 150 years, since Davy obtained a light from a large group of batteries, but progress was slow until the techniques of evacuation and filament-drawing led to rapid developments early in this century, and now the incandescent filament lamp in general service may be regarded as having reached nearly the peak of its efficiency.

Discharge and arc lamps, although invented earlier than filament lamps, are still in relatively early stages of their development, and the lighting industry can still look forward to brighter and more varied sources of light. At present we are in a period of consolidation, learning to apply the developments of the past ten or fifteen years, and it is very appropriate that a review of the present state of production and application should be published by those most closely associated with electric-lamp manufacture.

This book gives an excellent outline of the design, properties and limitations of present-day production. After a brief historical survey and a section on the scientific fundamentals of light emission, there is a section on filament lamps giving the standard properties and the effects of likely variations in the operating conditions for general service lamps, projector lamps and over a dozen types of other lamps designed for special service. The section on discharge lamps covers the whole alphabetical range from MA to ME and SO/H, with a very welcome table showing what these letters signify, and giving much of the information required by the designer and by an installation engineer concerned with these lamps. Fluorescent hot cathode lamps have a section to themselves, including the circuit details for the 8-ft. lamps, which is as comprehensive as possible under changing conditions. The final section of ten pages tabulates the principal data in a somewhat more practical fashion than in the relevant British Standard Specifications.

The short section on the cold cathode fluorescent lamps might well be amplified in the next edition, and reference might be made to the long-life projector lamps covered by the recent British Standard, 1546 : 1949. Data on the colour-rendering properties of fluorescent lamps will doubtless be issued separately when some simple means of expressing them has been found. This book does not attempt to cover the properties of the fittings or the accessories with which electric lamps may be used, and it relates, of course, only to the lamps made by the members of E.L.M.A. Throughout the book, however, there are a number of useful hints and warnings relating to operating conditions.

"Electric Lamps" will fill a gap on many bookshelves and there is no doubt whatever that lighting engineers will read it carefully and with benefit. J. G. H.

New Lighting Installations

Lighting a London Showroom

In the planning of the lighting scheme for Hunt and Winterbotham's new shop in Old Bond-street, an endeavour was made to combine the functional requirements of this type of shop, which is intended primarily for the display of cloth, with a lighting composition of sufficient variety and flexibility to have different effects in daytime and after closing hours. This end was achieved by close co-operation between the architect, Mr. Michael Rachlis, who made it possible to integrate the lighting scheme in the architectural design, and the lighting consultant, Mr. Anthony Juer.

The scheme was based on specially designed reflectors and fittings, and the choice of light sources was made with the twofold aim of blending the light in such a way as to avoid monotony and to provide, where required, the best possible colour rendering.

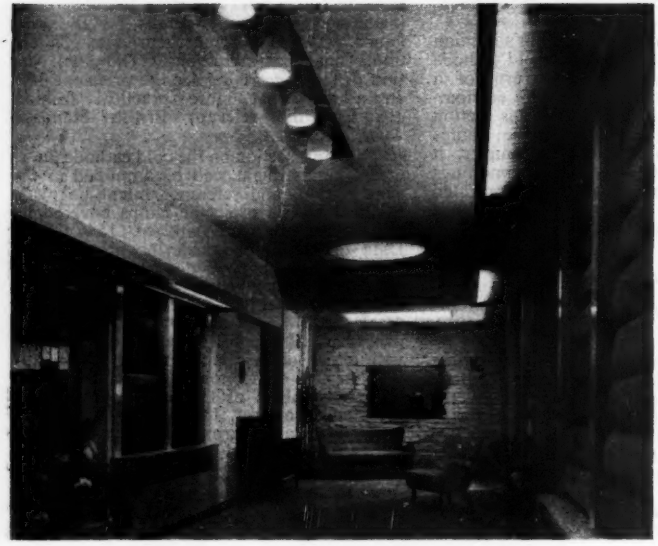
The types of lamps used are daylight and natural fluorescent tubes and tungsten filament lamps. By dividing up circuits in a special way, the lighting can be adjusted in daytime to requirements and set after closing hours to call attention to the materials and to emphasise the effect of the perspective.

Canteen Lighting

Enjoyment of a meal is greater if good food looks attractive, is tastefully served, and is consumed in pleasant surroundings. Enterprising restaurateurs place particular emphasis upon creating the right sort of atmosphere for their patrons.

Progressive employers appreciate the importance of providing good food and canteen facilities, but to gain the maximum benefit, a little extra care in the decoration and lighting helps towards the complete comfort of employees during the meal.

The artificial lighting installed should give a pleasing psychological effect, and should in fact be regarded as an additional amenity which ensures the feeling of well-being and contentment which dieticians insist is essential to obtain full benefit of the food. Modern lighting practice is to use fluorescent tubes and fittings, and with the lamps and fittings now available, and present ideas of decoration, the old difficulties of colour distortion of foods need no longer be an obstacle in



Interior of the new Bond-street premises of Hunt and Winterbotham. Note fluorescent lights behind aluminium louvres for lighting the rolls of cloth.

Exterior of the shop showing the striking effect of the concealed lighting on the rolls of cloth.

the way of attaining the best results. A good example of the joint planning of decoration and lighting is the staff canteen at Crompton House, Aldwych, London, W.C.1, shown in the photograph. This was carried out by the Lighting Department of Crompton Parkinson, Ltd., and the requirements were studied carefully in order to obtain decorative appeal and colour effect needed to create a pleasant atmosphere.

Careful tests were taken to ensure that the right proportion of light from the Crompton "Natural" coloured tubes was reflected from the various ceiling and wall

Fluorescent lighting in the canteen of Messrs. Crompton Parkinson Ltd., at Crompton House, Aldwych.

surfaces, which were painted in colours selected to give the right effect on all foodstuffs.

The result is that such things as coffee, tea, butter, cheese, beetroot, cooked meats, mustard, etc., look attractive and natural. They do not acquire those peculiar hues which sometimes have tended to be so disturbing to the consumer because the food appears unappetising.

Naturally, care has been taken to avoid direct glare to any of the occupants of the room, and to provide sufficient illumination both for the consumption of food and also for recreational activities.

The finish of the panels in the fittings ensures high lighting efficiency with a soft upward glow which eliminates dense ceiling shadows and yet allows the equipment to be simply and well maintained. The downward light is controlled by a lattice louvre, which gives a pleasant diffused effect. Below the level of the table tops, colours which would be detrimental at a higher level are widely used to provide that degree of colour contrast necessary to satisfy the eye. The result is that with a ceiling finished off-white towards pink and walls of a light cream to sunlight, an altogether satisfying and clean atmosphere results. Light green table tops with sycamore edges and darker green seats give an attractive contrast with the light brown patent block floor.

It is not suggested that these colour combinations should be used in all cases. Each case should be studied by lighting and colour experts in relation to the size and other characteristics of the room and, after proper appraisal of all the factors, then a correct choice of colour of decorative features and lamp can be linked to the design of fitting necessary to distribute the right amount of light in every direction. A little attention to such matters in the early stage of any project saves much disappointment and costly alterations later.

Shop Lighting

The illumination of a shop concerned solely with ladies' wear requires very careful consideration as to the choice of lighting fittings, for in a good class establishment elegance and low brightness characteristics are very important factors.

Messrs. Jax Stores have had one of their Oxford-street premises illuminated with fluorescent equipment which certainly fulfils these important requirements.

The twin 40-watt "Atlas" fittings which are used have a louvred lower panel with crinothene side panels, and incorporate "Atlas" quickstart control gear. Illumination on counter top varies little from 20 lm./ft.^{2}, and this standard, from 4,500 deg. K "Daylight" tubes, has achieved extremely good colour rendering results.

The architect was J. Curtis, F.R.I.B.A., and the lighting equipment was designed and supplied by Thorn Electrical Industries, Ltd.

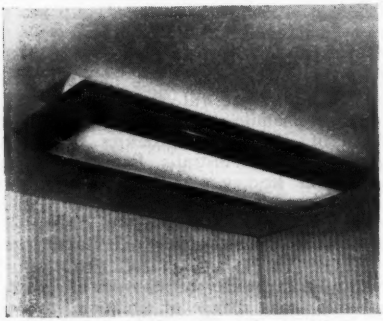
Interior of Jax Stores, Oxford-street.

LIGHTING FITTINGS

MERCHANT ADVENTURERS, LTD., have recently developed a new range of lighting fittings for tungsten and fluorescent lamps, including table lamps, pendant and bracket fittings. The table lamp unit incorporates an anodised aluminium reflector, an adjustable flexible tube and a weighted, anodised

Half-bowl tungsten bracket fitting by Merchant Adventurers, Ltd.

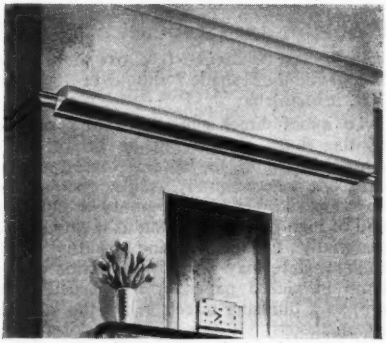
aluminium base with a mahogany insert. Models are also available for clamping to desks or drawing-boards or for mounting on walls. Also for use with tungsten lamps is a half-bowl wall-bracket in anodised aluminium or stove-enamelled colour spray fitted with a cluster of polished plate-glass fins which are brightly illuminated to light the underside of the bowl. Fluorescent fittings



Fluorescent ceiling fitting by Merchant Adventurers, Ltd.

include a unit which may be used either for pendant or bracket fitting with reeded, sand-blasted glass sides and "Perspex" ends. The control gear is housed inside the fitting. A feature of these fittings is the lightness of appearance, as both ends and the sides are illuminated and dust-collecting surfaces are reduced to a minimum. Another fluorescent pendant fitting is shown on this page. This is also available with a hinged louvre instead of the reeded glass as shown. This unit is available for use 2, 3 or 4, 4-ft. 40-watt or 5-ft. 80-watt lamps and can also be made up into continuous units of any length.

An interesting fluorescent fitting for home lighting is the Atlas cornice lighting unit by THORN ELECTRICAL INDUSTRIES, LTD.



The Atlas home cornice lighting fitting.

The unit is designed for indirect lighting, the unit being attached by means of two hooks on to a picture rail or small blocks fixed to the wall. The fitting itself weighs only 7½ lb. The fitting uses 4-ft. 40-watt lamps and is fitted with a suppressor to ensure trouble-free radio reception. All reflecting surfaces are finished in white stove-enamel, and the exterior parts are finished in Portland stone colour. The price, with control gear and lamp, is £2 19s., purchase tax being 9s. 3d. extra.

New fittings announced by PHILIPS ELECTRICAL, LTD., include the "Axminster," "Apsley" fittings for fluorescent lamps, and the "Westbury" for tungsten lamps. The "Axminster" is representative of a new design of open-end, detachable reflector fittings

for use with one or two 80-watt lamps, with stove-enamelled or vitreous reflectors with closed or open tops. The "Apsley" is for single 80-watt lamps and has a "Perspex" panelled louvre diffuser, suitable for shops, showrooms, stores, etc. The list price of this fitting, without lamp, is £25 11s. 8d., including tax. The "Westbury" is a semi-indirect pendant fitting designed for use with 160-watt and 250-watt blended lamps or 200-watt and 300-watt tungsten lamps. The bowl and suspension are finished in cream, the louvre being grey. List prices are: 200-watt, £9; and 300-watt, £9 2s. 6d.

METROPOLITAN-VICKERS ELECTRICAL CO., LTD., announce a new heavy-duty weatherproof floodlight projector, designed for concentrated beam, diffusing beam or rectangular throw, according to the type of front selected.

The body is made from Silicon aluminium alloy casting, with a cast stirrup of the same material, and with an internal reflector of polished anodised aluminium.

New Metrovick heavy duty floodlight.

Problems for Students *(Continued from page 70)*

lamp should be about 2 ft. above the base of the stand; the "shade" should be 18 in. to 2 ft. in diameter.

To avoid direct glare, the outer surface of the shade should not be bright; it is allowable for it to have a low transmission, but it may equally well be opaque. In any case its inner surface should be diffusing and of high reflection factor, as it contributes materially to the lighting of the page. Indirect glare may occur by reflection of the lamp in glazed paper or a polished table top, so a diffusing screen below the lamp is advantageous. If this is in the form of a translucent bowl, it serves both purposes of preventing reflected glare and of softening the upward light from the fitting by diffuse reflection.

The dimensions of the fitting should be in proportion; it must not appear either top-heavy, or pedestal-heavy. Any desired decorations may be incorporated, but simplicity in design adds to ease of maintenance as well as beauty. It should be well balanced, so that it does not tend to fall over. A local switch (or other fuel control) must be provided, and may often be located conveniently in the base of the pedestal. The switch, lamp-holder and wiring (or equivalent accessories) must be of good quality, and well secured, and the material of the shade should be durable.

B.S. 710 (1948) for Electric Reading Lamps should be consulted.

SITUATIONS VACANT

LIGHTING DESIGN ENGINEER to prepare fluorescent and other lighting schemes in London office of electrical manufacturers. Nat. Cert. E.E. Lighting training and experience necessary. I.E.S. member preferred. British National about 30. Please give full information to Box 805.

SENIOR DESIGNER-DRAUGHTSMAN required for development section of leading Lighting Equipment Manufacturer in Enfield area. Previous experience in design of fluorescent and tungsten industrial fittings, street lighting and floodlighting equipment essential. Pension scheme in operation. Applications to include details of experience, age and salary required.—Box No. 930, Dorland Advertising Ltd., 18-20, Regent-st., S.W.1.

SITUATIONS WANTED

LIGHTING DEPARTMENT MANAGER (35), prominent I.E.S. member, long and highly successful record with large electrical manufacturer covering the whole field of illumination, desires a senior appointment in Australia. Excellent opportunity for leading manufacturer to obtain the services of a representative having wide experience, initiative and the ability to succeed. Replies in confidence.—Box B.

REGISTERED LIGHTING ENGINEER with wide experience of all types of lighting schemes seeks change of situation, London or Southern Counties. Fullest details and references given.—Box C.

I.E.S. ACTIVITIES

I.E.S. Register of Lighting Engineers

On February 1 the regulation permitting corporate members of the I.E.S. who had the requisite experience to apply for inclusion in the Register of Lighting Engineers without the necessity of first passing the City and Guilds examination, lapsed. It is understood that quite a number of I.E.S. members who were eligible under this clause and who had previously omitted to make application, succeeded in lodging their application before the door was closed. As a result the I.E.S. office is now faced with a considerable number of applications and it will no doubt be some time (probably several months) before the last has been prepared for and submitted to the Registration Board. No doubt applicants will appreciate this and remembering that they were given two years in which to make their applications will not be impatient at a delay of a few months.

Forthcoming Visit to the B.R.S.

Arrangements have been made for a party of I.E.S. members to visit the Building Research Station at Garston, near Watford, on Tuesday, March 28. The visit will be a whole-day one and the party will be conveyed to and from Garston by coach, leaving 32, Victoria-street, at 10 a.m. On arrival at the B.R.S., at approximately 11.15, the party will be given a brief introductory talk on the work carried out there after which they will be able to see various aspects of the work themselves before having lunch. After lunch the party will be taken by coach to Abbotts Langley where they will be able to see experimental building work being carried out. Tea will be available on return to Garston, the party finally leaving the B.R.S. at about 4.15 p.m., returning to Victoria-street at 5.30 p.m.

The number of places available on this visit is limited and members wishing to take part should write to the I.E.S. Secretary, 32, Victoria-street, London, S.W.1, as soon as possible, enclosing cheque or postal order for 6s. to cover cost of coach, but not lunch or tea for which a small charge will be made.

Birmingham Centre

The annual dinner of the Birmingham Centre, was held at the Imperial Hotel, Birmingham, on Friday, January 6, when 150 members and guests were present under the chairmanship of Mr. Phillip Hartill, A.M.I.E.E., F.I.E.S.

After the toast to H.M. The King had been given by the chairman, the Lord Mayor of Birmingham (Alderman Hubert Humphreys, J.P.) rose to propose the toast of "The Illuminating Engineering Society," and during a topical speech, mentioned he was one of the first to install gas-filled electric lamps in his house. Shortly afterwards he had been visited by Mr. Bernard Shaw, with the result that the Shaws adopted these lamps in their own home. The following Christmas he received a card from Mrs. Shaw, addressed, "To the man that brought light into our house."

Mr. Howard Long, M.I.E.E., F.I.E.S., an honorary member of the Illuminating Engineering Society, who responded to the above toast, gave some interesting details of growth of the Centre from its inception to present time, and emphasised the growing co-operation and interest now being shown in the work of the Society.

To Mr. P. Hartill, as chairman of the Centre, fell the important duty of proposing the toast to "The Guests," to which Mr. J. W. Donovan, B.Sc., M.I.E.E., chairman of the South Midland Centre of the I.E.S., replied.

It has been the practice of the Birmingham Centre over the last few years, to invite members at one meeting during the session to give short papers on any subject connected with lighting. This symposium of papers has proved most interesting and the four papers presented at the meeting on January 13 proved to be no exception to the rule. Each speaker was allowed approximately 10 minutes to present his subject.

The first paper was "A New Colour Matching Unit and its Applications," presented by Mr. M. K. Johnston. Mr. Johnston gave a clear description of the difficulties to be met with in colour matching and produced a sample of the unit. This was in the form of a deep box with diffusing glass front, and contained two 60-watt tungsten lamps and two 40-watt fluorescent of a special blue colour. Mr. Johnston stated that the colour temperature of the light produced at 6,500 deg. K. was substantially the same as a black body radiating at the same temperature.

The next paper was "A Town's Public Lighting." Mr. G. E. Kemp gave a most interesting description of his town's lighting

and the trials and troubles in installation and maintenance.

A third paper by Dr. A. J. Holland on "Unusual Glasses" started with a description of single-glass beads, dating from 5000 B.C. found in the coffins of the Pharaohs and their queens, and a quotation from a description dated about 750 B.C. on how to make a glaze.

Finally, Mr. K. F. Haylor talked on a "Design Centre for an Illuminating Engineering Office." Mr. Haylor described the assembly of a reference library and file from world-wide sources including other manufacturers catalogues.

All the papers were of a high level and a most interesting discussion followed. One gentleman present could even remember how, during the manufacture of ruby glass, the "boss" appeared on the scene to cast a handful of sovereigns into the "pot."

A vote of thanks to the speakers was proposed by Mr. J. W. Forth and received with great enthusiasm.

Newcastle Centre

On January 18, the Newcastle Centre held their annual dinner when nearly 100 members and guests were present.

In the speech following the dinner, the toast of the I.E.S. was proposed by Mr. A. Watt, vice-chairman of the Institute of Electrical Engineers, who referred to the work carried out by the Society and pointed out that good lighting was the result of the co-operation of all concerned and observance of the I.E.S. code.

The response was made by Dr. J. N. Aldington, president of the I.E.S., who said that this was the first dinner he had been able to attend since he had taken office as president. He said that the I.E.S. did not exist to train illuminating engineers, but to provide occasions and opportunities by which its members may improve their knowledge of the principles of good lighting, which it did by meetings in London and in the various towns where there are centres and groups. In the future, he said, he hoped that work would be encouraged by vision in application as well as in purely technical details in lighting. In its early days, the art of lighting had been beset with many difficulties and there were still difficulties to be faced. At present, technical advances had outpaced lighting applications. For instance, in the home we tolerated conditions which would not be permitted in factories. Too often it was the question of economics which prevented good lighting as, for example, in the streets where we still have a colossal loss of life at night. There was a need to educate those in high places in the necessity for good lighting.

Mr. A. J. Ogle, chairman of the centre, then proposed the toast of "The Guests" and said how the members of the Newcastle Centre always looked forward to these occasions when they were able to welcome the president. He recalled with pleasure the outstanding personalities in the lighting field whom the centre had had the pleasure of receiving. In referring to Dr. Aldington's work, he recalled the success of his recent lecture to over 2,000 people at the Newcastle City Hall. He welcomed guests from the Institute of Electrical Engineers, the Northern Architectural Association, the Electrical Contractors' Association, representatives of the Birmingham and Leeds Centres and the Secretary of the Society.

The reply to the toast was given by Mr. F. Austin Child, President of the Northern Architectural Association.

Huddersfield Group

"Cold Cathode Lighting" was the title of the lecture at the January meeting of the Huddersfield Group. Mr. E. A. Langsdon, was the lecturer.

Mr. Langsdon introduced his subject with a brief description of the construction of cold cathode fluorescent tubes and pointed out the differences between such tubes and the hot cathode type. He discussed details of the lamps in relation to the efficiencies that could be obtained and showed that longer lamps had a higher efficiency because under similar operating conditions there was a constant loss per pair of electrodes whatever the length of tube. Experience had shown, however, that there was an optimum tube length which gave the best practical results. This figure was from 10 to 12 feet. The life of cold cathode tubes was much in excess of hot cathode and could be generally assumed to be 10,000 hours.

The electrical circuits necessary to operate cold cathode tubes was then extensively dealt with. As is generally known the mains supply voltage has to be stepped up by means of transformers to the necessary value. Transformers have to be designed to give the required voltage to strike the arc and to give a lower voltage to operate the tubes. The method of "leaky reactance" transformer had proved to be very satisfactory. Mr. Langsdon gave a very good pictorial description of such a transformer without going into technical details of transformer design. He gave values of open circuit voltages which he said would be of sine wave form. When the tube was operating however this wave form would not be sinusoidal. The design of the transformer could influence the stroboscopic effect of the light output and this point was illustrated by diagrams on lantern slides.

Mr. Langsdon then dealt with the

economics of this type of lighting in relation to capital cost, energy consumption and replacements. His opinion was that cold cathode could compete with other forms of lighting in certain situations and that it was a better proposition in other cases.

The discussion in which many members and visitors took part was opened by Mr. E. G. Scholey.

A further interesting lecture on "Visual Fatigue," by Mr. A. B. Nutt, was given on February 3.

He explained that the eye was an extremely complex structure, and that, in effect, anything which went wrong with any part of it, and so gave pain, constituted eyestrain. Eyestrain arose from fatigue in controlling the functioning of the iris which limited the amount of light entering the eye, or from excessive effort in focussing, say small detail in bad light, or from difficulties in maintaining stereoscopic vision by means of co-ordinated eye movement.

Fatigue, Mr. Nutt said, was often psychological, for conditions which upset one person seemed not to affect others at all. Physical and mental condition, coupled with environment, affected the amount of visual fatigue considerably. Among the environmental conditions those that the eye could stand least included glare either from unshaded lights or from shiny surfaces, and flicker. Strain should be treated by either improving the environment or by medical attention to physical or mental conditions in the individual.

Forthcoming I.E.S. Meetings

LONDON

March 1st
Informal Meeting. Problems Evening. (At the Lighting Service Bureau, 2, Savoy Hill, W.C.2.) 6 p.m.

March 14th
Sessional Meeting. Messrs. W. E. Harper and P. H. Collins on "The Design of Acrylic Mouldings for Flameproof Mine Lighting Fittings." (Joint Meeting with the Association of Mining, Mechanical and Electrical Engineers.) (At the Lighting Service Bureau, 2, Savoy Hill, London, W.C.2.) 6 p.m.

March 28th
Visit. To the Building Research Station, Garston. (Ticket only. A coach will leave 32, Victoria Street, at 10 a.m.)

April 11th
Sessional Meeting. Mr. E. S. Calvert on "Aerodrome Lighting." (At the Lighting Service Bureau, 2, Savoy Hill, W.C.2.) 6 p.m.

CENTRES AND GROUPS

March 1st
Mr. M. W. Peirce on "Floodlighting Practice." (At the Minor Durant Hall, Oxford Street, Newcastle-on-Tyne.) 6.15 p.m.

March 2nd
Mr. D. E. Beard on "Lighting for Sports and Games." (At the South Wales Electricity Board Demonstration Theatre, The Hayes, Cardiff.) 5.45 p.m.

March 3rd
Mr. I. M. Robertson on "Lighting of the Brabazon and Hangar." (At the South Western Electricity Board Showrooms, Bath.) 7 p.m.

March 3rd
Mr. W. Imrie-Smith on "Some Notes on Industrial Lighting." (At the Electricity Showrooms, Market Street, Huddersfield.) 7.15 p.m.

March 6th
Mr. J. K. Frisby on "Shop Window and Display Lighting." (At the Medical Library, The University, Western Bank, Sheffield 10.) 6 p.m.

March 9th
Mr. W. R. Stevens on "Film Studio Lighting." (At the Demonstration Theatre, East Midlands Electricity Board, Leicester Sub-Area, Charles Street, Leicester.) 6.30 p.m.

March 9th
Open Forum. (At the Reynolds Hall of the Manchester College of Technology, Sackville Street, Manchester.) 6 p.m.

March 10th
Annual General Meeting. Mr. A. M. Steel on "School Lighting—The Architect's Problem." (At the Imperial Hotel, Temple Street, Birmingham.) 6 p.m.

March 10th
Mr. I. M. Robertson on "Lighting of the Brabazon and Hangar." (At the Agricultural House, Queen Street, Exeter.) 7 p.m.

March 13th
Mr. G. G. F. Halliwell on "Railway Light Signalling Systems." (At the Lighting Service Bureau, 24, Aire Street, Leeds 1.) 6 p.m.

March 15th
Messrs. G. K. Lambert and W. D. Sinclair on "Exterior Lighting by Fluorescent Lamps." (At Cleveland Scientific and Technical Institution, Corporation Road, Middlesbrough.) 6.15 p.m.

March 16th
Mr. A. Wilcock on "Lighting of Recreation Centres." (At the Yorkshire Electricity Board, 45/53, Sunbridge Road, Bradford.) 7.30 p.m.

March 21st
Mr. T. Catten on "Lighting on R.M.S. Queen Elizabeth and R.M.S. Caronia." (At the Lecture Theatre of the Merseyside and North Wales Electricity Board's Showroom, Whitechapel, Liverpool 1.) 6 p.m.

March 22nd
Annual General Meeting and Dinner. (Edinburgh Centre.)

March 23rd
Mr. D. A. Strachan on "The Problems Associated with Underground Lighting in British Coalmines." (At the East Midlands Gas Board, Demonstration Theatre, Parliament Street, Nottingham.) 5.30 p.m.

March 24th
Dr. J. N. Aldington. Presidential Address. (At the Imperial Hotel, Temple Street, Birmingham.) 6 p.m.

March 30th
Annual General Meeting followed by Presidential Address and Dinner. (Glasgow Centre). 7 p.m.

March 31st
Mr. H. L. Privett on "The Latest in Electric Lamps." (At the Electricity Showrooms, Market Street, Huddersfield.) 7.15 p.m.

April 4th
Mr. C. Campbell on "Light and Crime Detection." (At the Lecture Theatre of the Merseyside and North Wales Electricity Board's Showroom, Whitechapel, Liverpool 1.) 6 p.m.

April 5th
Annual General Meeting, to be followed by a paper by a local member. (At the Minor Durant Hall, Oxford Street, Newcastle-on-Tyne.) 6.15 p.m.

April 12th
Mr. S. D. Callaway on "Lighting of Steelworks." (At the Y.M.C.A., Swansea.) 6.p.m.

April 13th
Mr. J. D. Callaway on "Lighting of Steelworks." (At the South Wales Electricity Board Demonstration Theatre, The Hayes, Cardiff.) 5.45 p.m.

April 14th
Mr. S. A. Wood on "Interior Decoration and its Influence on Illumination." (At the Imperial Hotel, Temple Street, Birmingham.) 6 p.m.

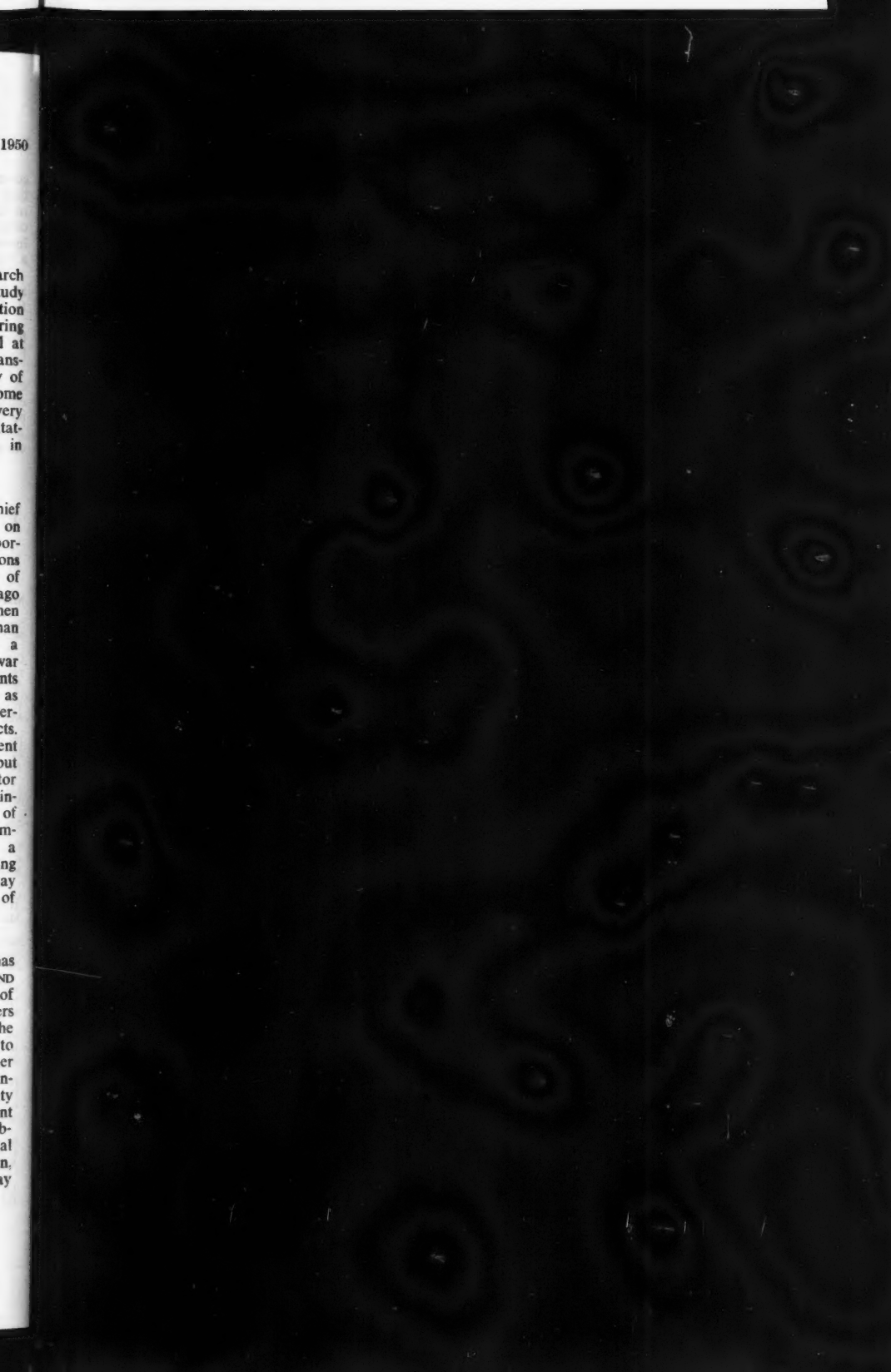
POSTSCRIPT

By "Lumeritas"

I noticed, in a recent issue of an architect's weekly journal, an illustrated article dealing with the design of a four-bedroom house which caused me some surprise. The only means for artificial lighting visible in the photograph of the living room was a bare lamp pendant from the ceiling near the window. Doubtless this was not actually the only artificial light source, nor, I hope, was it typical of the others. Possibly someone forgot to clothe the lamp before exhibiting the apparently finished and furnished room to the camera's searching eye. The room appeared to be well designed for day lighting. I cannot believe the architect planned for artificial lighting by naked lamps, but the simple ceiling-rose and pendant flex shown in the photograph did not suggest that the lighting "fitting," when it is installed, is likely to be one well suited to the room.

The Report of the Medical Research Council for the years 1945-1948 (Cmd. 7846), which has just been published by H.M. Stationery Office, mentions an interesting investigation concerning lighting which was made by the Council's Applied Psychology Research Unit. The object was to ascertain the importance attached by workers to the various conditions of work. The investigator, Mr. J. W. Whitfield, "compared the importance of illumination as assessed by different individuals with the actual intensity of the illumination at their job. It was found that, for a constant type of fitting (i.e., lighting unit), the higher the intensity of illumination, the lower the importance which was placed on the factor of lighting." So when, as in the present case, individuals are asked to compare the importance of various conditions of work, apparently what they really do is to compare the prevailing conditions on the basis of the satisfaction each condition gives; or, to put the matter the other way round, on the basis of the amount of improvement each condition is thought to need. Thus, the more satisfactory the prevailing illumination at the job, the less important, i.e., the less in need of improvement, is lighting considered to be. It is added that "quite apart from intensity, moreover, the type of fitting had a powerful influence on the opinions expressed."

The same report, dealing with the work of Mr. H. C. Weston's Group for Research in Occupational Optics, mentions the study made of the effect of age and illumination upon the performance of work requiring the visual discrimination of small detail at close range. Readers of the I.E.S. Transactions have already had an opportunity of seeing a full report of this study, while some of the results obtained were dealt with very briefly in the article on Methods of Facilitating Visual Tasks which was published in LIGHT AND LIGHTING last September.

According to the Report of the Chief Inspector of Factories for the year 1948, on which I commented last month, the proportion of factory accidents due to persons falling (and the frequency of occurrence of such accidents was shown many years ago to be greater in the winter months, when artificial lighting is used extensively, than in the summer months) showed only a slight fall during 1948. During the war years the percentage of all factory accidents due to falls of persons rose appreciably, as did the percentage of accidents due to persons stepping on or striking against objects. The figures for both these classes of accident have now fallen to about the 1938 level, but in this connection the chief inspector remarks that "places of access remain insufficiently lighted." While the lighting of working areas has been considerably improved in many factories, until a corresponding improvement in the lighting of "places of access" is made, there may be no further reduction in the number of accidents of the kinds mentioned.

I am glad to see that correspondence has reappeared in the pages of LIGHT AND LIGHTING. The letters on the subject of lighting terms seem likely to provoke others and, if this proves to be so, I hope the Editor will not hastily apply the closure to this correspondence. It is evident that neither here nor in the U.S.A. is there complete unanimity of opinion regarding the suitability of some of the technical terms in the current lighting vocabulary. This is one of the subjects under consideration by the National Illumination Committee of Great Britain, but the views and suggestions of others may well be stimulating and valuable.